



WP/15/15

IMF Working Paper

Does Supply or Demand Drive the Credit Cycle? Evidence from Central, Eastern, and Southeastern Europe

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European Department

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Authorized for distribution by **Daria Zakharova**

January 2015

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Abstract

Countries in Central, Eastern, and Southeastern Europe (CESEE) experienced a credit boom-bust cycle in the last decade. This paper analyzes the roles of demand and supply factors in explaining this credit cycle. Our analysis first focuses on a large sample of bank-level data on credit growth for the entire CESEE region. We complement this analysis by five case studies (Latvia, Lithuania, Montenegro, Poland, and Romania). Our results of the panel data analysis indicate that supply factors, on average and relative to demand factors, gained in importance in explaining credit growth in the post-crisis period. In the case studies, we find a similar result for Lithuania and Montenegro, but the other three case studies point to the fact that country experiences were heterogeneous.

JEL Classification Numbers: G10, E32, E51

Keywords: Credit, Credit Demand, Credit Supply, Eastern Europe, Disequilibrium Model.

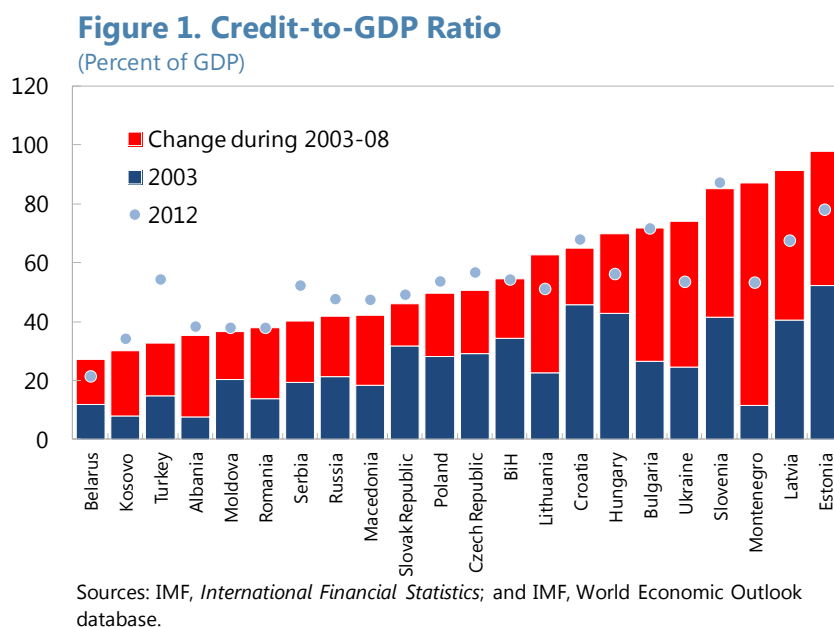
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¹ We would like to thank Shekhar Aiyar, Bas Bakker, Jihad Dagher, Aasim Husain, Christoph Kligen, Julie Kozack, Mahmood Pradhan, John Ralyea, Martin Saldias, Andrea Schaechter, Daria Zakharova and other colleagues at the IMF for valuable comments.

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I. INTRODUCTION

Countries in Central, Eastern, and Southeastern Europe (CESEE) experienced a common credit cycle. For the countries in the region, credit expanded very rapidly over 2003–08—during this period the credit-to-GDP ratio increased on average by some 30 percentage points. However, as the global financial crisis struck, credit growth stalled or became negative. As a result, the credit-to-GDP ratio fell or stabilized in the period 2009–12 (Figure 1).²



The rise and fall in the credit-to-GDP ratio reflects both demand and supply factors (Box 1). Initially, strong credit growth took place in the context of convergence towards, and integration with, the rest of Europe. It was supported by the presence of Western banks with easy access to liquidity, which contributed to low real interest rates. This fueled a domestic demand boom, which eventually led to the buildup of macroeconomic and financial imbalances. The ensuing bust and correction of these imbalances was accompanied by a pronounced economic slowdown, heightened economic uncertainty, and a withdrawal of funding by parent banks. This left households, corporates, and banks overly indebted and in need of balance sheet repair. At the same time, and in response to the perception that credit extension had become excessive during the boom, banks tightened lending policies. While this experience was common across the region, there was also considerable variation across countries in the importance of specific factors—for instance, parent bank funding was central to the boom in the Baltic countries, while countries with greater reliance on domestic sources of funding and/or with flexible exchange rates avoided more imbalances (see IMF 2012).

² Turkey is the only notable exception.

The goal of this paper is to analyze the role of demand and supply factors in explaining the recent credit cycle in CESEE. A better understanding of the drivers of the credit cycle is not only helpful to better interpret past developments, but it can also shed light on the causes of the current anemic credit growth. Understanding these causes is essential to informing the role of policy in helping to revive credit growth. If, for example, weak credit growth is mainly explained by weak credit demand in the wake of sluggish business activity, economic policies aimed at reducing the cost of credit and expanding aggregate demand would be appropriate. If, instead, credit supply is posing a constraint, for instance as the result of the sudden withdrawal of parent bank funding or banks' lower willingness to take risks in the presence of large nonperforming loans, policies would need to focus on enhancing coordination with parent banks to ease sudden changes in the funding profile or on improving the resolution framework for nonperforming loans.

Box 1. Common Factors of the Boom-Bust Credit Cycle

During the boom, rising demand and supply for credit led to rapid credit expansion. On the demand side, strong economic growth, rapid income convergence, rising house prices, and low real interest rates were forceful drivers. In some countries, pro-cyclical fiscal policies further added to the domestic demand boom. On the supply side, unprecedented inflows of external funding into the region increased the supply of credit (as documented in IMF, 2012). The latter was facilitated by the presence of foreign-owned subsidiaries in the region (which typically operated in a common EU market) with access to cheap parent bank funding (which in turn was made plentiful by parent banks' access to cheap wholesale funding). Moreover, emerging Europe was considered to be 'under-banked', had low levels of debt across sectors, and had positive economic growth prospects. Cheap access to external financing combined with favorable profit opportunities also gave rise to lax lending standards, which further augmented the supply of credit.

After the 2008/09 crisis, demand and supply for credit fell sharply. Following the collapse of Lehman Brothers, countries in the CESEE region experienced pronounced economic slowdowns (or recessions), and demand for credit fell as a result. Credit demand also declined as borrowers ended up overly indebted—incomes fell and house prices dropped, and un-hedged borrowers in countries with flexible exchange rates (where lending in foreign currency was quite common) also faced the implications of unfavorable exchange rate adjustments. On the supply side, the crisis led to a very sharp decline in global risk appetite and a reversal of capital flows to the CESEE region. At the same time, banks themselves came under severe market pressure to build capital and liquidity buffers, which reduced their capacity to lend. Further on the supply side, rising NPLs led banks to tighten lending standards, while looming uncertainty about firms' and households' future economic prospects also weighed on supply. Crisis-related stress also translated into higher funding costs for banks and/or lower interest margins which also depressed credit supply.

Disentangling the role of credit demand and credit supply is an inherently difficult task. The difficulty stems from several factors. First, credit demand and supply are unobservable: only actual credit outcomes can be observed. Second, while some factors can be considered to generally drive demand and others supply, there are also factors that drive both. Hence, the econometric identification of factors determining demand vs. supply is not straightforward. Progress in this area has been recently achieved through the use of matched bank-firm

lending datasets (e.g. Khwaja and Mian, 2008; Amiti and Weinstein, 2013; Kapan and Minoiu, 2013). Given the unavailability of such rich data for the CESEE region and to mitigate the possible challenges posed by this identification problem, we use two complementary approaches to analyze credit demand and supply:³

- *A cross-country panel study.* In the first approach (Section II), we use a bank-level panel dataset for the CESEE region to analyze credit growth. Both bank-specific variables and macroeconomic variables are used to explore the relative roles of supply and demand factors in explaining credit growth. The analysis focuses on how the *relative* role of demand and supply factors changed after the crisis and varied by bank ownership status (see also IMF, 2013a).
- *Country case studies.* In this approach, we take the analysis a step further and estimate credit demand and credit supply themselves (rather than actual credit growth). We use a disequilibrium model of credit demand and supply to do so, focusing on five country case studies (Latvia, Lithuania, Montenegro, Poland, and Romania). This analysis allows us to determine, for each country and at each point in time, whether credit demand or credit supply was constraining the growth of credit. Hence, it allows inferring the *absolute* importance of credit demand and credit supply in a model of quantity rationing (Section III).

Our findings suggest that both demand and supply factors explain the evolution of credit growth, that the relative importance of demand and supply factors has shifted over time, and that there is significant heterogeneity across countries.

- *From the cross-country panel results,* we find that on average for CESEE countries, both demand and supply factors matter in explaining credit growth, but the sensitivity of credit growth to supply factors increased post-crisis, whereas that of demand factors (particularly macroeconomic factors) decreased. This implies that the *relative* importance of supply factors increased after the crisis. Analysis in IMF (2014) using bank-level credit data for the three Baltic countries broadly confirms these findings.
- *In the case studies,* we find that both credit supply and credit demand rose during the boom and fell during the bust. In line with the findings of the panel results, we find that supply-side constraints became more important in the late-crisis period in some countries (Lithuania and Montenegro). At the same time, the findings suggest that country experiences are heterogeneous and reflect country-specific circumstances (the intensity of the boom, the availability of funding, the depth of the output collapse, etc.).⁴ Country-specific macroprudential policies may be an additional factor in

³ Our focus in this study is on domestic credit. We thus abstract from cross-border lending to non-banks, even though we acknowledge that this channel of credit provision is significant in most CESEE countries (see chapter 4 of IMF (2011) for a discussion).

⁴ See for instance Eichengreen and Steiner (2008) for a discussion on how the boom in Poland differed from other countries in Europe.

explaining heterogeneity across countries but this paper does not focus on the role of macroprudential policies in explaining credit developments as such.⁵

An extensive body of literature on credit growth dynamics in transition and other emerging market countries precedes this paper. While a complete literature review is clearly beyond the scope of this paper, the early strand of the literature focused on the role of privatization and foreign bank entry on banking system performance (Claessens and others, 2001, Bonin and others, 2005; Haas and Lelyveld, 2006; Havrylchyk and Jurzyk, 2010) or credit allocation (Aydin, 2008; Degryse and others, 2009), pointing to the generally positive role of foreign bank presence. A different strand of literature analyzed to what extent fast credit growth was (initially) seen as financial deepening that is helpful for economic growth in catch-up economies, or whether it (later onward) represented excessive growth prescient of a credit boom-bust (Cottarelli and others, 2003; Hilbers and others, 2005; Duenwald and others, 2005; Égert and others, 2006; Enoch and Ötoker-Robe, 2007; Eichengreen and Steiner, 2008; Tressel and Detragiache, 2008). The role of international capital flows and parent funding has also featured prominently, for instance in Bakker and Gulde (2010), Lane and McQuade (2012), Mendoza and Terrones (2012), or IMF (2013a). The role of loan demand and discouragement is examined for CESEE countries in Brown and others (2012).

The rest of the paper is organized as follows. Section II presents our cross-country analysis. Section III presents the five case studies. Section IV concludes. Greater details on the data we used as well as robustness checks are contained in the five appendices.

⁵ See for instance Vandenbussche, Vogel, and Detragiache (2015) for an analysis of macroprudential policies' impact on housing price inflation and housing credit in 16 CESEE countries as well as for a review of the literature on the effectiveness of macroprudential policies.

II. REGIONAL BANK-LEVEL PANEL ANALYSIS

We start by analyzing the determinants of credit growth using a large cross-country bank-level panel dataset. Bank-level data from Bankscope on credit growth and bank financial variables are matched with *time-varying* information on bank ownership, taken from Impavido, Vandebussche, and Zeng (2015)'s dataset. The sample includes more than 400 banks from 20 countries (all countries in the CESEE region except Russia⁶; for a comprehensive list see Appendix I) and covers the period 2001–11. These annual data are matched with macroeconomic variables taken from the WEO database and global financial variables taken from Bloomberg. Banks in the top and bottom 1 percent of the distribution of each bank-level variable (except for bank size) were considered to be outliers and were dropped from the sample. Basic descriptive summary statistics and details on data coverage are included in Appendix I.

The estimation strategy is panel fixed effects,⁷ and proceeds in three steps (see Box 2). Bank-level credit growth is explained by regressing it on a set of financial and macro variables which are standard in the empirical literature.⁸

- *First, we analyze the relation between credit growth, macroeconomic variables and bank characteristics on average over the sample period.* In particular, annual real credit growth (in local currency) of bank i at time t is regressed on a set of (lagged) individual bank characteristics, contemporaneous domestic macroeconomic variables, and the contemporaneous EMBIG spread. The latter controls for global perceptions of risks to emerging market countries. We also control for the 2008/09 crisis and for bank ownership (domestic versus foreign) by including a set of dummies. The results provide a basic understanding of the relative importance of demand and supply factors among the explanatory variables.
- *Next, we examine how this relation changed during the crisis period.* We do so by interacting the macroeconomic and bank variables with a crisis dummy.
- *Finally, we explore whether bank ownership differences explain the evolution of credit during the crisis.* We do so by interacting the macroeconomic and bank variables with a dummy that captures both bank foreign ownership and the crisis. We also supplement the regressors with parent bank characteristics.

⁶ Russia is excluded for two reasons. First, in the raw dataset, more than half of the observations are Russian banks. If included in the regressions, they would likely drive the results for the CESEE region as a whole. Second, data on customer deposits for Russian banks in Bankscope use a different definition from such deposits in other CESEE countries.

⁷ Due to the relatively short time dimension of the panel, mean group estimators or co-integration analysis was not used.

⁸ Although it is likely a very relevant variable e.g. due to significant mergers and acquisitions that took place in CESEE countries (Fritsch and others, 2007), we do not include banking sector competition as an explanatory variable because of difficulties in measuring it consistently (See Demirgüç-Kunt and Martínez Pería, 2010). See Gorton and He (2005) for theoretical underpinnings of the role of competition and strategic behavior of banks, and an application to the U.S., or Amiti and Weinstein (2013) for the role of competition among banks in the case of Japan.

Box 2. Estimation and Model Specification of Panel Regression

The basic regression uses the following specification. Real growth of gross loans in bank i , country j , at time t , $g_{i,t}$ expressed in local currency is regressed on:¹

$$g_{i,t} = c_i + \alpha \cdot \text{macro}_{j,t} + \lambda \cdot \text{EMBIG}_t + \beta \cdot \text{bank}_{i,t-1} + \gamma \cdot D_{\text{crisis}} + \delta D_{\text{foreign}} + \theta \cdot D_{\text{crisis}} \cdot D_{\text{for}} + \varepsilon_{it}$$

Bank-specific fixed effects c_i , macroeconomic variables at time t in country j $\text{macro}_{j,t}$, the EMBIG spread at time t , bank-specific financial variables at time $t-1$ $\text{bank}_{i,t-1}$, a dummy taking the variable 1 for the crisis years 2008–11 D_{crisis} , a dummy for banks which are foreign-owned² D_{foreign} , and an interaction term to control for the joint effect of the crisis and foreign ownership, $D_{\text{crisis}} * D_{\text{for}}$.

Macroeconomic and bank specific explanatory variables. Following the literature on bank credit, a set of typical variables are included to control for the macroeconomic conditions and bank fundamentals. We note the expected sign of the variables in parentheses.

- **Domestic macroeconomic variables.**
 - *Real domestic demand growth* (+) reflects the strength of the overall economy and is expected to have a positive impact on credit growth. Real domestic demand was used instead of GDP as domestic demand was a critical driver of the financial cycle. From the perspective of an individual bank, contemporaneous domestic demand growth is assumed to be an exogenous variable, and not to depend on the banks' own credit growth.³ Hence, no lags are used for the real domestic demand growth variable.
 - *Average inflation* (-) captures both possible internal imbalances and monetary policy credibility. The sign is expected to be negative as lack of price stability deters financial transactions and inflation erodes bank capital.
 - *The exchange rate was insignificant and dropped from the regressions.* We tested for its significance as most banks operating in the CESEE region had a significant stock of foreign currency loans during the sample period (or countries experienced euroization in their financial sectors), so the volume of their loan portfolio would be expected to vary mechanically with exchange rate fluctuations. When we include a variable capturing aggregate revaluation effects (at the country level) in the regression, it turned out to be insignificant and was dropped. The insignificance is likely due to the high (0.5 percent) correlation with the inflation rate, which ended up being significant in the regressions.
- **Global variables.** The *EMBIG spread* (-) is expected to be negatively correlated with credit growth, as higher risk aversion towards emerging markets is likely to lower credit growth. The contemporaneous EMBIG spread is used since from the perspective of an individual bank the contemporaneous EMBIG spread can be assumed an exogenous variable.
- **Bank variables.** We include a number of variables, all of them are lagged by one period to minimize any possible endogeneity bias:
 - *Bank assets-to-GDP (bank size to GDP)* (-). It is expected that larger banks grow more slowly than smaller ones.
 - *Loan-loss reserves as a percent of gross loans (reserves to gross loans ratio)* (-). High loan loss reserve ratios often indicate poor bank asset quality and therefore are expected to have a negative effect on credit growth (see also Nier and Zicchino, 2008).
 - *Net loans as a percent of customer deposits (net loan to deposit ratio)* (-), indicating the degree of financial leverage (with net loans being gross loans net of provisions). To the extent this implies the bank is more financially stretched, this is expected to be negatively

^{1/} Credit is measured in domestic currency (in euros for Kosovo and Montenegro).^{2/} A bank is considered to be foreign-owned if it has a foreign global-ultimate-owner that controls 25 percent or more of its total shares. Ownership status can change over time.

^{3/} While a standard assumption, the 'granular' approach (e.g. Gabaix, 2011; Amity and Weinstein, 2013), challenges it.

Box 2. Estimation and Model Specification of Panel Regression (continued)

correlated with credit growth.

- Liquid assets as a percent of the sum of customer deposits and short-term funding (*liquid assets to deposits and st funding ratio*) (+). Higher available liquidity (in the preceding period) is expected to facilitate greater credit expansion.
- Equity as a percent of net loans (*equity to net loan ratio*) (+), which measures solvency or capital adequacy. Better capitalized banks are expected to be less constrained in their ability to expand credit.
- Return on average equity (*return on equity*) (+), indicating bank profitability. More profitable banks are expected to be in a better position to extend credit.
- We performed many robustness checks, and the variables we included in the specification reported here are only those whose effects remained significant and carry the same sign across all checks.⁴

Subsequent specifications add the following dimensions:

- **Year dummies and interaction terms.** Instead of including a single dummy for the crisis, dummies for each year of the crisis are included. Also, principal variables such as $macro_{j,t}$, and $bank_{i,t-1}$ are interacted with a dummy for the crisis period, to allow the effects of these determinants to vary during the boom and the bust periods.
- **Impact of foreign ownership.**
 - Since we are interested in analyzing whether having a foreign parent bank matters for credit creation in the host country, we focus on the difference between domestically-owned banks and subsidiaries or branches of foreign banks through the inclusion of a dummy variable on foreign ownership. Foreign ownership is hence restricted to those banks that are owned by foreign legal entities that are banks, with banks that are owned by foreign legal entities other than banks or foreign natural persons being excluded from the sample. The assumption is that subsidiaries or branches of foreign banks are different due to their integration into the strategy of larger cross-border banking groups (e.g. with respect to funding, capital, liquidity management). We first interact the foreign ownership dummy with a dummy for each of the years of the crisis to capture whether the impact of foreign ownership on credit growth changed over the crisis years.
 - We then replace the foreign ownership dummy with parent bank characteristics to examine the impact of differences in parent bank fundamentals across foreign-owned subsidiaries/branches on the latter's credit growth. Specifically, we include parent bank home country CDS spreads to proxy for parent bank funding costs (-), and the lagged parent bank equity to total assets ratio as a proxy for the capital strength of the banking group (+), along with its interaction with a crisis dummy.
 - We dropped variables that were not significant. These included some bank characteristics or their interaction terms that turned out insignificant, as well as alternative parent bank characteristics. In particular, we tried to include the (lagged) ratio of parent bank net loans to deposits to proxy for financial leverage at the banking group level, and the parent bank cost-to-income ratio as a proxy of parent bank profitability. These variables, however, turned out to be insignificant.

⁴Data constraints prevented the inclusion of a bank-specific cost of funding variable in the regressions. For banks that are subsidiaries of larger banking groups (regression column (3)), the CDS spread of the home country was used as a proxy for parent bank funding costs. This proxy allowed for greater data coverage and yielded qualitatively similar results as using either the parent bank CDS when available, or the average of the CDS of the three largest parents of the same home country.

The explanatory variables in the regression can be interpreted as more representative of either credit demand or credit supply. With obvious caveats attached, we consider some variables to mostly drive the demand for credit, and other variables to reflect the supply side.

- *Domestic macroeconomic variables* such as the growth in domestic demand are likely to affect credit through both supply and demand channels. However, we assume here that domestic macroeconomic variables mostly reflect demand factors (in the context of the panel regressions, variation in bank characteristics is assumed to capture changes in credit supply factors).
- *The EMBIG spread* is assumed to reflect both demand and supply factors. On the one hand, higher spreads may reflect higher (global) uncertainty, and therefore negatively affect investment decisions, and reduce the demand for credit. On the other hand, higher spreads affect the cost of bank funding and, through that channel, the supply of bank credit. As a result, we do not tag this variable as being on either side.
- *Individual bank characteristics* are assumed to reflect supply factors as they indicate banks' capacity or willingness to lend.
- *Foreign ownership variables* are considered to be a very specific supply factor, since foreign ownership may facilitate access to foreign funding—over and beyond funding from traditional sources of funding, such as deposits. Given its unique role and importance in the region, the foreign bank dimension is explored separately.

Our findings suggest that both demand and supply factors played a role in explaining credit growth. The first column in Table 1 reports on the basic regression specification and shows that most of the coefficients are significant and carry the expected sign. Domestic demand and inflation are both significant, with the former positively correlated with credit growth and the latter negatively correlated with it. The EMBIG spread is also significant and carries the expected negative sign. On the supply side, we found a significant impact as well, as banks tended to expand their lending more rapidly when (i) they were smaller; (ii) their asset quality was better; (iii) their solvency was higher; and (iv) they were more liquid.

The size of the coefficients of the supply and demand factors, however, changed over time. The second column in Table 1 shows the results when we interact the macroeconomic and bank-specific characteristics with a crisis dummy, allowing the size of the coefficients to change over time. Our results show that, after the crisis, the size of the coefficients on the bank-specific variables such as *reserves to gross loans ratio*, *net loan to deposit ratio* and *return on equity* increased. This implies that, given equal fundamentals, banks extended less credit after the crisis than before. The results further suggest better liquidity and capital adequacy both had positive effects on credit growth during the pre-crisis period, but in the post-crisis period, solvency became a much more important factor in banks' lending decisions—during the crisis, the coefficient of liquidity was reduced, while that on solvency increased significantly. At the same time, the coefficient on domestic demand fell. In particular, while during the period 2001–07, a one percentage point in domestic demand was

associated with a 1.8 percentage points increase in banks' annual real credit growth, a similar size shock during the downturn of 2008–11 is associated with an impact less than half that size. The impact of inflation on credit did not change over the financial cycle (and so the table shows the result when the interaction term is dropped).

The change in size of the coefficients suggests that the relative importance of supply factors increased during the crisis, but some caveats apply. We can infer from these findings that the sensitivity of credit to supply factors increased in the post-crisis period compared with the pre-crisis period, while the sensitivity of macroeconomic factors decreased somewhat. However, a few caveats apply when interpreting these coefficients.

- The crisis dummies aim to say something about the *relative* importance of supply and demand factors, and so do not say anything about the change in the *absolute* importance of demand versus supply factors.
- The drop in the size of the domestic demand coefficient during the crisis is also to some extent in line with expectations for two reasons. First, there is an inherent asymmetry in that credit (a *stock* variable) can more flexibly adjust on the upside (by growing) compared to the downside (by shrinking), especially as credit can grow as long as more funding is available, but its decline is constrained by the timing of debt repayments.

Our findings also show that foreign ownership is a reinforcing supply determinant and affects the response to some bank fundamentals. Several interesting findings emerge:

- First, foreign ownership, after controlling for all other factors, is associated with significantly higher credit growth, as the dummy for foreign ownership is highly significant (column (1) in Table 1). The effect of foreign ownership, when interacted with the different crisis years (column (2) in Table 1), however, diminished over time.
- Second, foreign banks behaved differently than domestic banks (column 3 in Table 1). While domestic banks grew faster when they were more profitable (higher *return on equity* coefficient), this appears to be true for foreign banks only during the crisis period; this is perhaps because, prior to the crisis, foreign banks did not depend as much on retained earnings to build capital and grow. We also find that foreign banks' credit expansion was more sensitive to solvency indicators (*equity to net loan ratio*) than domestic banks' credit expansion, but this effect holds throughout the cycle. It suggests that foreign banks had a greater propensity to leverage and deleverage—foreign banks used additional capital to leverage up more than did domestic banks, and the loss of bank equity affected credit growth more in foreign banks.⁹ Similarly, foreign banks also reacted more negatively than domestic banks to

⁹ Average equity to net loan ratios for domestic banks were also higher than for foreign banks, both in the pre- and post-crisis sample period, suggesting that foreign banks used more leverage.

lower asset quality (higher *reserves to gross loans* coefficient) throughout the cycle. Foreign banks did not respond differently from domestic ones to global and domestic macro factors.

- Third, among foreign banks (column 3 in Table 1), the ownership effect on credit growth seems to depend on two key parent bank characteristics, i.e. home country CDS spreads and solvency. Other parent bank characteristics were found to be insignificant (see Box 2). A stronger sovereign helps because of the lower funding costs that are transmitted to the parent and of the greater likelihood of contingent sovereign support to a parent in trouble. The effect of the parent's solvency on credit growth in the subsidiary became much weaker after 2008, reflecting the parents' greater need to accumulate capital in the new market and regulatory environments, and the greater autonomy given to the subsidiaries throughout the region since the crisis hit.

Table 1. CESEE: Determinants of Credit Growth (2001–11)

Dependent variable: real annual loan growth (in percent)			Dependent variable: real annual loan growth (in percent)		
	(1)	(2)		(3)	
EMBIG spread	-0.014*** (0.005)	-0.019*** (0.005)	EMBIG spread	-0.024*** (0.006)	
Real domestic demand growth	0.977*** (0.100)	1.794*** (0.199)	Real domestic demand growth	1.544*** (0.194)	
x crisis dummy		-1.252*** (0.235)	x crisis dummy	-0.865*** (0.222)	
Average inflation	-0.806*** (0.119)	-0.754*** (0.119)	Average inflation	-0.656*** (0.117)	
Bank size to GDP (first lag)	-2.911*** (0.428)	-3.804*** (0.530)	Bank size to GDP (first lag)	-3.146*** (0.498)	
x crisis dummy		0.852*** (0.263)			
Reserves to gross loans ratio (first lag)	-1.238*** (0.209)	-0.629*** (0.219)	Reserves to gross loans ratio (first lag)		
x crisis dummy		-0.763** (0.346)	x crisis dummy	-1.077*** (0.403)	
			x foreign dummy	-1.785*** (0.440)	
			x crisis x foreign dummy	1.373** (0.534)	
Net loan to deposit ratio (first lag)	-1.238*** (0.209)		Net loan to deposit ratio (first lag)	-0.062*** (0.018)	
x crisis dummy		-0.066*** (0.018)			
Equity to net loan ratio (first lag)	0.497*** (0.059)	0.428*** (0.060)	Equity to net loan ratio (first lag)	0.402*** (0.066)	
x crisis dummy		0.626*** (0.106)	x crisis dummy	0.309*** (0.087)	
			x foreign dummy	0.643*** (0.119)	
Liquid assets to deposits and st funding ratio (first lag)	0.212*** (0.053)	0.258*** (0.059)	Liquid assets to deposits and st funding ratio (first lag)	0.219*** (0.054)	
x crisis dummy		-0.222*** (0.078)			
Return on equity (first lag)	0.207*** (0.058)		Return on equity (first lag)	0.163* (0.085)	
x crisis dummy		0.165** (0.074)	x foreign dummy	-0.410*** (0.157)	
			x crisis x foreign dummy	0.587*** (0.149)	
Foreign dummy	19.511*** (3.648)	19.965*** (3.578)	Parent bank equity to net loan ratio (first lag)	2.479*** (0.435)	
dum_crisis	-4.808* (2.543)				
dum_foreign_crisis	-5.092* (2.920)				
dum_f2008		7.745** (3.717)	x crisis dummy	-1.951*** (0.442)	
dum_f2009		-5.672 (3.768)	Parent bank home CDS spread	-0.037*** (0.010)	
dum_f2010		-6.747* (3.478)			
dum_f2011		-8.236** (3.560)			
Number of observations	2,415	2,415	Number of observations	2,093	
R-squared	0.336	0.372	R-squared	0.404	
Number of banks	435	435	Number of banks	415	
Bank fixed effects	yes	yes	Bank fixed effects	yes	

Sources: Bankscope, Bloomberg, WEO database, and authors' calculations

Notes: Results are obtained through a fixed effect estimation. Standard errors are reported in parentheses. ***, **, and * indicate a p-value lower than 1 percent, 5 percent, and 10 percent respectively. A dummy for Belarus in 2010 is included to take into account a break in the series for Belarusian banks in that year.

III. CASE STUDIES

In the next part of our analysis, we explore the role of credit demand and supply in five case studies. The case studies complement the earlier analysis by allowing for differentiation of results across countries. They cover Latvia, Lithuania, Montenegro, Poland, and Romania, which were specifically selected because of their heterogeneity (Figure 3). The group includes countries with fixed and flexible exchange rates, at different stages of economic and financial development, in different geographical areas of the CESEE region, with diverse structures of their banking systems, and with variations in the strength of their post-crisis recoveries.

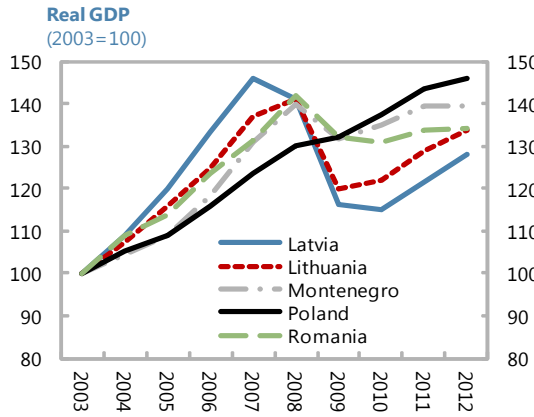
The approach used in the case studies seeks to establish whether credit growth is constrained by credit demand or credit supply. To do this, we jointly estimate credit demand and credit supply, using a disequilibrium model in which actual (new) lending is assumed to be the lower of the estimated demand or supply of credit (Box 3).¹⁰ In other words, the model allows us to assess whether credit demand or credit supply was the factor constraining the evolution of actual credit. The disequilibrium model is underpinned by the assumption that credit demand and supply do not necessarily settle in equilibrium at the observed price level (i.e. the interest rate), as non-price factors are assumed to also play a role. In other words, the model estimates quantity rationing in which supply and demand change beyond what is reflected in interest rates or prices.¹¹ While the panel regressions in Section II focused on analyzing the *relative* role of credit demand and credit supply factors and their effects *pre-* and *post-*crisis, this model allows us to also look at the *absolute* strength of credit demand and credit supply and how they evolved over the *entire* estimation period. In this sense, the analysis of Section III attempts to complement and further enrich the results of Section II. Details are provided in Appendix III.

¹⁰ The flow of new lending (in real terms) is used here and this is different from the left hand side variable (real credit growth) used in the panel regressions.

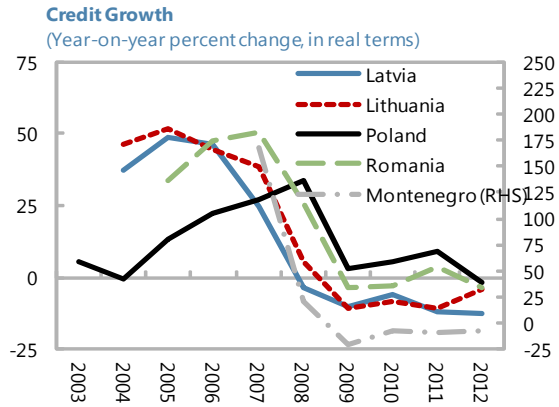
¹¹ The advantage of using a quantity rationing model is that it allows for the fact that borrowing costs do not fully reflect availability of credit in the presence of financial frictions. Berger and Udell (1992) present evidence of credit rationing and price ‘stickiness’. A more recent application can be found in Waters (2012) who uses a DSGE model of quantity rationing and estimates a VAR to show that lending standards, as measured in surveys of bank managers, are an important determinant of capacity utilization and output, while the role of borrowing costs is not quantitatively significant.

Figure 3. Case Studies: Boom and Bust Cycle

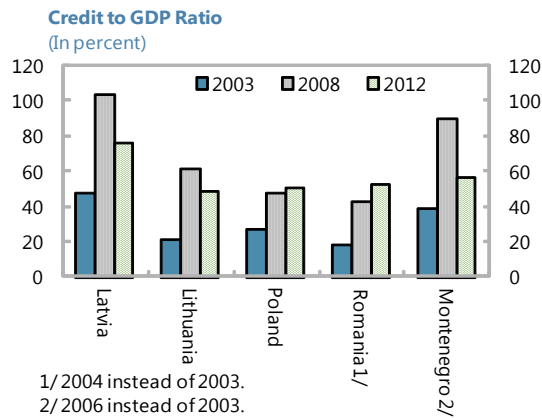
After the boom, GDP contracted sharply (except in Poland) ...



... and earlier credit growth reversed course; for some, it has been negative for several years.

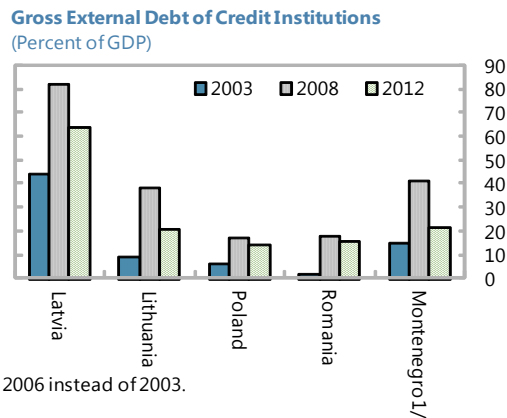


As a result, credit-to-GDP adjusted, but this varied by country...



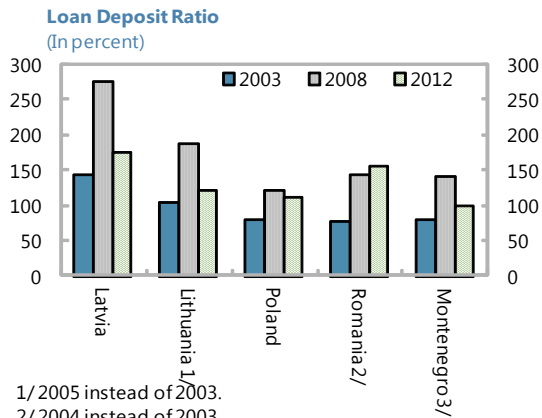
1/ 2004 instead of 2003.
2/ 2006 instead of 2003.

... along with parent funding reversals that also varied by country.



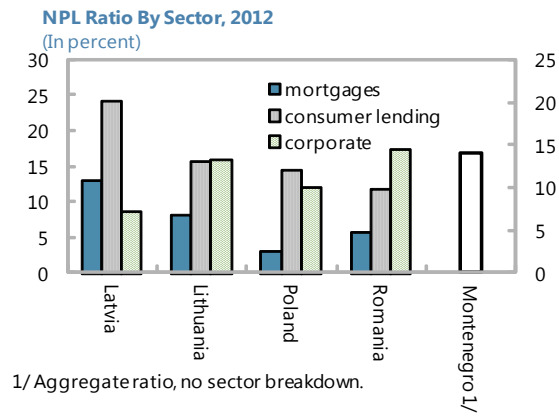
1/ 2006 instead of 2003.

Loan-to-deposit ratios have gradually come down (except in Romania).



1/ 2005 instead of 2003.
2/ 2004 instead of 2003.
3/ 2006 instead of 2003.

But NPLs increased, with some sectors more affected than others.



1/ Aggregate ratio, no sector breakdown.

Sources: IFS; Haver; national authorities; and IMF staff estimates.

Box 3. Estimation and Model Specification of Disequilibrium Model

The disequilibrium model can be summarized as follows. Credit supply and credit demand are simultaneously estimated in a system of equations with endogenous switching proposed by Laffont and Garcia (1977). More recent applications include Pazarbasioglu (1997), Ghosh and Ghosh (1999), Kim (1999), Barajas and Steiner (2002), and Poghosyan (2010). The underlying assumption is that the interest rate is not perfectly flexible to clear the market. In other words, apart from price factors (the interest rate), non-price factors also determine supply and demand for credit. As a result, supply and demand do not necessarily clear at each observed price point—allowing the market to be in disequilibrium and to exhibit quantity rationing. Observed new lending C_t is then assumed to be the minimum of the estimated demand for credit (C_t^D) and estimated supply for credit (C_t^S), or:

$$\begin{aligned} C_t^D &= \beta_1' X_{1t} + \varepsilon_t^D, \\ C_t^S &= \beta_2' X_{2t} + \varepsilon_t^S, \\ C_t &= \min(C_t^D, C_t^S), \end{aligned}$$

The vectors X_{1t} and X_{2t} contain the explanatory variables of credit demand and supply respectively, including both the interest rate as well as non-price determinants. The error terms ε_t^D and ε_t^S are assumed to be jointly normal and independent over time, with a zero mean and a covariance matrix Σ .

Estimation technique and robustness.

- Estimation is performed using the maximum likelihood method proposed by Maddala and Nelson (1974). Compared to more standard regression techniques, the switching regression technique implies that the results are more sensitive to the specification used, since the observed dependent variable (actual credit) is equal to only one of the dependent variables in the model (e.g. credit demand), with the other one (e.g. credit supply) being unobservable.
- To improve the stability of the estimation and the precision of the predicted values, insignificant variables are usually dropped from the regressions (unless explicitly stated), with the exception of the interest rate which is always retained in both the credit demand and credit supply equations.
- The fit of the model can be assessed by comparing actual credit with the minimum of either demand or supply (see Appendix IV).
- We assess whether the estimated excess supply is statistically significant using Monte Carlo simulations to compute confidence intervals.¹ We report the fixed-error confidence bands derived from averaging the standard deviation of the predicted excess supply across observations. Time varying-confidence bands (which allow the standard deviation to vary at each point in time) are provided as a robustness check in Appendix V.

^{1/} For calculation of the significance bands, we used the point estimate of the parameter vector, the estimated variance covariance matrix, and normally distributed shocks to generate an alternative parameter vector. Using the alternative parameter vector and the observed values for the regressors (which are the same across repetitions), we constructed a fitted value for demand, supply and excess supply. This process is repeated a large number of times (typically 5,000). For each observation, we computed the mean and the standard deviation of the predicted excess supply across repetitions.

The dependent variable in the regressions is new loans extended (a flow variable), in real terms.¹² Real new loans include both new loan contracts and rollovers of existing loans. We use either the monthly flows, or a 3- or 6-month smoothed average of these monthly flows. A moderate amount of smoothing is done in cases where the monthly data display a degree of noise that interfered with the estimation. While this brings some potential disadvantages, namely concerns about potential endogeneity (e.g. credit at time $t-2$ may impact indicators of economic activity at time t), smoothing has the advantage of averaging out conditions between the time the decision to obtain financing was made and the time credit was obtained, taking into account that a time lag may occur to sign loan contracts, which requires preparation and elaboration of underlying business plans or pledging of collateral. Hence, we view a moderate amount of smoothing as acceptable. In three of the five country cases, regressions are estimated separately for new loans to households and new loans to non-financial corporates (referred to as NFCs or corporates hereafter), but this depended largely on data availability. The estimation uses monthly data with interpolations of quarterly data where needed (for details, see Appendix III).

The choice of explanatory variables for credit demand and credit supply is determined by *a priori* exclusion restrictions, along with pragmatism. The lending rate, as the price-clearing mechanism, enters both the credit demand and credit supply equations. For other variables, we use *a priori* exclusion restrictions even if such *a priori* exclusion is not always obvious. For example, some variables can affect both demand and supply (such as variables associated with economic conditions or debt overhang), while others are more clearly associated with either credit demand or credit supply factors. The variables discussed below are grouped into broader categories, with the expected sign of the coefficient indicated with the (+) or (-) sign. Not all variables are used in each country case (see Appendix III for country-specific details):

- *On the demand side*, the explanatory variables are:
 - The *cost of credit* (the real lending rate (-), inflation expectations (+));
 - *Economic conditions* for the economy (confidence surveys (+), changes in stock market indices (+), indicators of current economic activity such as real GDP, retail sales, industrial production, or new orders (+), uncertainty about the future proxied by the volatility of consensus forecasts (-) or for corporates and households (profitability prospects based on survey data (+), real wage growth (+), employment growth (+), unemployment rate (-));
 - *Debt overhang* (debt stocks in percent of GDP (-), corporate and household NPL ratio (-)); and
 - *Alternative funding* sources for corporate borrowers (profit or cash developments (-), stock market returns (-), surveys on firms' financial constraints (+)).

¹² In countries where the new credit data are not readily available, new credit is derived as the sum of change in credit stock and loan amortization, while loan amortization is inferred from the original maturity structure of credit stock. This may result in overestimating or underestimating the actual new credit, but as long as the maturity structure does not exhibit large fluctuations, the estimation results should not be affected.

- *On the supply side*, the explanatory variables are:
 - The *return on credit* (the real lending rate (+), interest margin (+), inflation expectations (-));
 - *Economic conditions* (confidence surveys (+), changes in stock market indices (+), indicators of current economic activity such as real GDP growth (+), value of collateral, such as real estate prices (+));
 - *Debt overhang* and borrower *creditworthiness* (NPL ratio (-));
 - *Funding costs* for banks or indicators of *financial stress* (real deposit or other funding rate (-)); and
 - *Capacity to lend* (deposits and/or parent funding (+), banking system capital divided by minimum capital requirements (+)).

With parent funding entering the supply side equation, we use a two-step estimation procedure to control for potential endogeneity. The concern about endogeneity arises from the fact that an increase in parent funding increases capacity to lend (supply). Yet, at the same time, parent banks also have the ability to quickly expand or contract available funding in subsidiaries in response to changes in credit demand (unlike deposits, which cannot expand or contract very quickly). To address this issue, we use a two-stage procedure to isolate the part of parent funding received by subsidiaries (or the change therein) that is attributed to health or stress of the parent bank (as proxied by parent banks' CDS spreads).¹³ However, for some countries, parent funding is either not very much related to parent bank stress (first stage), or local lending is not driven by the amount of parent funding that responds to parent bank stress. For that reason, we pragmatically decide which specification of parent funding is the most appropriate for each country.

While the model shows some degree of sensitivity to the particular estimation specification, both demand and supply are generally estimated within reasonable error bands. Predicted credit and actual credit—a test of the fit of the model—are fairly close to one another (see figures in Appendix IV). Most of the coefficients have the expected signs, but the interest rate is at times not significant. Estimated demand and supply are plotted in the panel figures accompanying the discussion of country results below. That said, the estimation results are somewhat sensitive to the model specification and the choice of variables used. This is due to the inherent complexity of the task, which implies estimating the path of two unobservable variables over time, as well as the limitations of maximum likelihood estimation which could result in converging on a local, rather than a global optimum.

¹³ We do so by first regressing parent funding (or the change therein) on a set of instruments using simple ordinary least squares. The instruments used in the first stage are parent bank (or if unavailable, home countries') CDS spreads, which capture the health of (or stress on) parent bank balance sheets. Second, the fitted values are then included in the supply equation. Hence, the fitted values reflect the available parent funding (or changes therein) that can be attributed to the health (or stress) of the balance sheet of the parent bank. This captures a narrower concept of variability in parent funding than if the total funding from parent banks is used, as it is only that part related to parent balance sheet health or stress. The significance of this variable in our regressions hence has to be narrowly interpreted.

Much like in the panel regressions, we find that both credit demand and supply factors matter, and that their strength varies over time. In particular, the results suggest that both credit demand and supply rose in tandem during the boom and jointly fell in the bust for all countries in our case studies. This mimics the credit cycle and supports the idea that both demand and supply have been important in explaining the rise and fall of credit.

We find heterogeneity across countries regarding the importance of demand and supply factors, mostly reflecting country specific circumstances. The timing and extent to which credit demand exceeds credit supply and vice versa, varies by country (discussed further below). For example, the results suggest that, for Montenegro and Lithuania, credit supply became more constraining in the post-crisis period which is consistent with the findings in the panel regressions in Section II (the constraint is now not only in the relative sense, but also in the absolute sense). However, for other countries examined in the case studies, simultaneously tightening supply and demand conditions contributed broadly equally to the contraction of credit in the bust period such that neither demand nor supply was the overriding constraining factor (the case of Latvia), or demand factors were constraining credit most of the time (Poland and Romania).

We discuss the country specific results in a particular order. We start by focusing on those case studies where we find most evidence of supply constraints, and hence, where the results most closely echo the findings of the panel regressions in Section II. This is the case for Montenegro, where we find supply constraints to be dominant both during the boom as well as during the post-crisis period, and for Lithuania, where we also find evidence of supply constraints, including in the post-crisis period. Next follows the case of Latvia, where the model estimates supply and demand factors to be broadly in balance (and where there is some role for demand constraints by NFCs). The final two case studies (Poland and Romania) cover countries where we did not find strong evidence of supply constraints, but rather that demand factors were the main drivers of credit.

Montenegro

For Montenegro, we find that supply constraints matter most in explaining credit expansion throughout the sample period. The model finds several periods of statistically significant excess demand (described below), but no periods of excess supply. In other periods, disequilibria were not statistically significant; implying both demand and supply played an equal role in explaining new credit extended. The periods of excess demand (that is, supply constraints) during the *boom* seem to reflect Montenegro-specific factors, while the supply constraints characterizing the recent period of the economic *recovery* are consistent with the findings of the panel regressions in Section II (and those of Lithuania, discussed below). The evolution of credit in Montenegro can be described in three periods:

- *Post-independence (before 2008)*. This period shortly followed the country's independence, when its untapped potential attracted large capital inflows, especially in the nontradable sector (see Box 5). Hence, this was a period where pent-up demand for credit co-existed for a short time with insufficient credit supply—even if credit supply was rising extremely rapidly (inflows of parent bank funding increased from 7 to 27 percent of GDP between 2006 and 2008). Under these circumstances, excess demand quickly disappeared by mid-2007.

Box 4. Montenegro. Estimation Performance

- *Joint estimation of credit to NFCs and credit to households*. The model for Montenegro is estimated for new credit to the nonfinancial private sector (with credit for households and NFCs jointly), as data on new lending to NFCs and to households could not be obtained separately.
- *Significance of coefficients*. On the demand side, the interest rate has the expected negative sign. Credit demand is positively correlated with real economic activity and negatively to the proxy for debt overhang. On the supply side, the interest margin is insignificant in the regression, but deposit growth is significantly and positively associated with credit expansion. The NPL ratio is negatively associated with credit supply (a finding that is consistent across countries).
- *Parent funding*. Parent funding, instrumented by the sovereign CDS spreads of home countries, is also significant and carries the expected positive sign in the supply equation. Its coefficient is lower than the coefficient on deposit funding, perhaps pointing to the critical role deposit withdrawals played during the early phases of the crisis.

Box 5. Montenegro

GDP per capita (US\$ PPP, 2012): 11,800

Population (2012): 622,000

Exchange rate regime: uses Euro

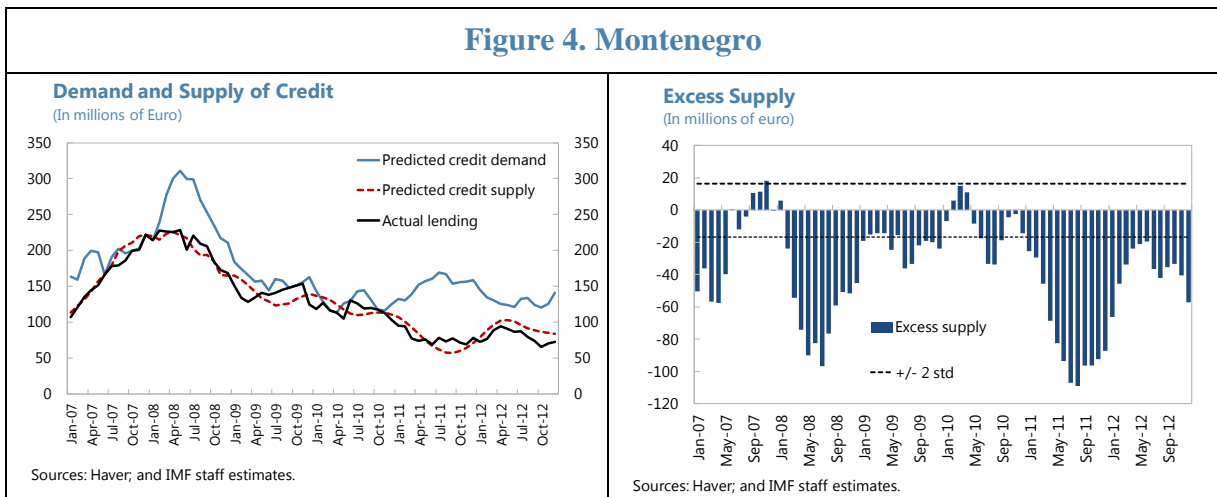


Montenegro's banking sector more than doubled in just two years following independence.

Upon independence in 2006, Montenegro quickly attracted international investors interested in Montenegro's untapped potential, especially in the tourism sector. This gave rise to large capital inflows and an economic boom led by investments in the real estate sector. During the period 2004–08, GDP growth averaged 7 percent, while the credit-to-GDP ratio increased from 38 to 89 percent of GDP between 2006 and 2008. The expansion of corporate credit far outpaced that of households, partially due to the importance of investments in the tourism industry and the construction boom. Credit expansion was facilitated by inflows of parent bank funding—about 70 percent of the banking sector was foreign owned—which increased from 7 to 27 percent of GDP between 2006 and 2008. The loan-to-deposit ratio peaked in 2008 at 141 percent. The Central Bank applied a number of measures to seek to stem credit growth. In 2006, it broadened the base for calculating reserve requirements. In 2007–08, it tightened reserve requirements further, increased the capital adequacy ratio from 8 to 10 or 12 percent for banks with credit growth in excess of 60 or 100 percent respectively, and capped annual credit growth to 30, 40, or 60 percent for banks with outstanding loans above 200 million, between 100 and 200 million, and below 100 million euro respectively. These measures, though having an effect on curbing credit expansion, were weakened by the pro-cyclical fiscal policy and capital inflows operating at the same time.

Credit sharply contracted after the bust, mainly reflecting supply factors. The initial impact of the crisis came from massive deposit outflows which tested the resilience of the banking system. While parent banks provided support in the immediate aftermath of the crisis, some important foreign banks that operated in Montenegro experienced severe financial stress and one (Hypo Alpe Adria) was nationalized by home authorities. Montenegrin subsidiaries had to repay the credit lines to parents in the subsequent period and parent bank funding fell from 27 to just over 10 percent of GDP between 2008 and 2012, while the loan-to-deposit ratio fell to below 100 percent as a result. Mirroring the sharp decline in foreign funding (along with moderate deposit growth), credit growth has been negative for four consecutive years (2009–12) and the credit-to-GDP ratio fell by some 34 percentage points of GDP over the same period—the largest decline among the case studies (see Table AII.2). While positive GDP growth has resumed, it has remained moderate as well. Meanwhile, the financial system has been left with high levels of NPLs, which are proving challenging to resolve or restructure, leaving the corporate sector riddled with high debt. The central bank has repeatedly reduced effective reserve requirement rates, and reduced the interest rate for reserve requirements for liquidity.

- Crisis (2008–10)*. The model estimates that credit supply leveled off as early as 2008, while credit demand continued to rise until mid-2008. But by mid-2008, credit demand starts to fall, reflecting global developments, and excess demand disappears by end-2008. Hence, this period seems to be a temporary period where supply was adjusting faster than demand. In terms of timing, the leveling off of credit supply in the estimation takes place somewhat before Montenegro experienced massive deposit withdrawals (from mid-2008 onward) and later, large reversals of parent bank funding (from mid-2009 onward) (see Box 5). However, the early drop in supply may be because NPLs were already rising in 2008, exceeding 7 percent by the end of that year (much above the average of 4 percent of the other four countries in the case study).
- Economic recovery (2011–12)*. The recovery seems to be associated with rising credit demand, but supply either continued to contract or stabilized over this period (but, according to the model estimates, did not rise). As a result, this period is characterized by supply constraints as well.



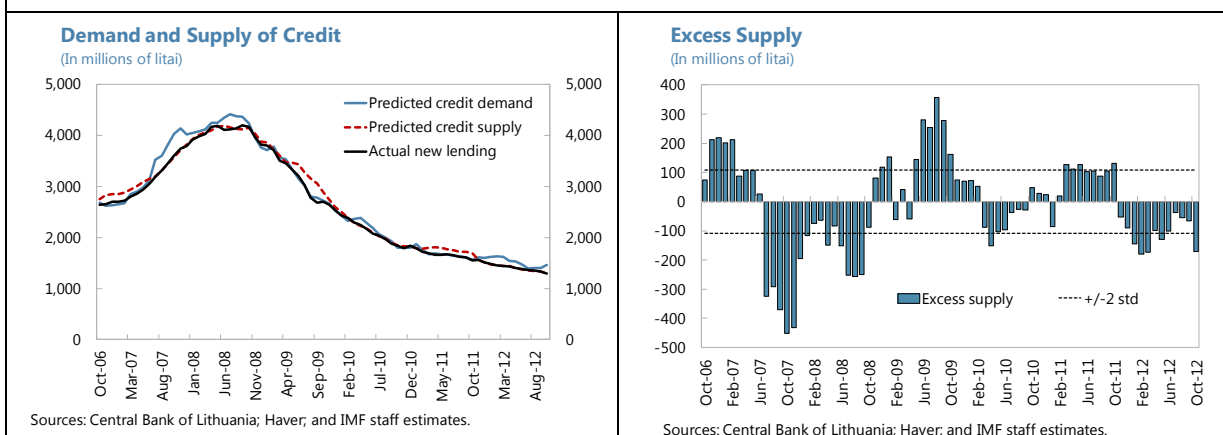
Lithuania

For the *boom* period, the model finds that credit supply factors dominated the pace of credit expansion. While the model estimates that both demand and supply rose during the boom, demand rose faster than supply, and the model finds evidence of statistically significant excess demand (supply constraints) during that period. This could be the result of the somewhat more moderate expansion in Lithuania of the credit-to-GDP ratio, even if demand factors such as GDP growth or economic prospect variables were similar to those in Montenegro or Latvia (discussed below). In particular, key credit supply determinants—such as deposits and parent funding—were less abundantly available in Lithuania compared with Latvia (see Box 7 and Box 8).

Box 6. Lithuania. Estimation Performance

- **Joint estimation of credit to NFCs and credit to households.** The model for Lithuania is estimated for new credit to the nonfinancial private sector (with credit for households and NFCs jointly), since credit to each sector evolved at about the same pace in Lithuania and therefore the two series are highly correlated.
- **Significance of coefficients.** Most coefficients have the expected sign and are significant. In the demand equation, it is worth pointing out that profit margins are significantly and positively related to credit demand. Also, the NPL ratio has a strong and significant role in determining supply of credit to private sector, with a higher NPL ratio being correlated with lower credit supply.
- **Parent funding.** In the supply equation, the size of the coefficient of parent funding, instrumented by the CDS of parent banks, is much larger than the coefficient on deposits, indicating a greater responsiveness of credit supply to parent funding than to deposit funding.

Figure 5. Lithuania



Since the bust, demand and supply evolve similarly, with two exceptions. Demand and supply for credit fell strongly after the 2008/09 crisis, but the economic recovery has not been matched by a recovery in credit demand or credit supply. The model estimates two short periods of small, but statistically significant imbalances. The first concerns a short period of

excess supply in 2009Q2–Q3, which merely seems to be the result of the slow adjustment of credit supply to the crisis.¹⁴ Credit market imbalances also become statistically significant from early 2012 onward, with credit demand somewhat exceeding credit supply—a result that is similar to the findings of the panel regressions. Interestingly, this period coincides with a period of significant excess liquidity in the banking system.¹⁵ However, factors such as difficult NPL resolution and strict lending standards may explain why supply constraints dominate during this period and anecdotal evidence confirms that NPL resolution has been particularly slow in Lithuania (see Box 7 and IMF, 2013c).

¹⁴ At this time credit demand is estimated to be sharply contracting, but deleveraging has not yet geared full speed. Excess supply disappears as soon as the first deleveraging episode starts (see Box 7 for a description of deleveraging episodes).

¹⁵ This period follows the Snoras depositor payout (4 percent of GDP), which led to an increase in liquidity in foreign owned banks. This, in turn, signals the start of the second deleveraging episode in Lithuania (see Box 7). This means that banks at that time were not constrained by capacity to lend.

Box 7. Lithuania

GDP per capita (US\$ PPP, 2012): 21,615

Population (2012): 3,007,758

Exchange rate regime: currency board



Lithuania and Latvia's boom share many similarities, but Lithuania's banking sector remained smaller in comparison. Lithuania and Latvia experienced similar growth conditions and convergence forces, and both countries' banking sectors were dominated by Swedish/Nordic-owned banks which had easy access to foreign funding. Yet, Lithuania's banking sector started out much smaller and remained the smallest of the three Baltic countries by 2008. Credit expanded from 23 percent of GDP in 2003 to 63 percent of GDP by 2008, with real credit growth averaging 37 percent per year over the period. Measured in percentage points of GDP change, the expansion of corporate credit was slightly greater than that of household credit, and household debt-to-income in 2006-07 remained at about half Latvia's. The more modest expansion of credit as a percent of GDP took place in a context where nonresident deposits were insignificant (in contrast with Latvia where they were sizeable) and where parent funding inflows remained somewhat below those in Latvia—even if the momentum of the scaling up of parent bank inflows was still very similar to Latvia. The loan-to-deposit ratio peaked at 187 percent in 2008Q4.

Credit collapsed with the onset of the bust; subsequent deleveraging took place in distinct phases. Credit contracted by 8.2 percent in 2009, while domestic demand sharply turned negative and output collapsed by 15 percent in 2009. On the deleveraging side, Lithuania did not formally benefit from the Vienna initiative, but the withdrawal of parent funding was initially moderate (e.g. compared with Latvia). It accelerated in two distinct phases—somewhat distinct from the rest of the region. A first phase occurred between October 2009 and April 2010. The second phase took place in the first half of 2012. The latter can be explained in the context of the bankruptcy of Snoras bank (the third largest bank by deposit base at the time). Snoras' bankruptcy and the depositor payout which followed (4 percent of GDP) increased liquidity of the foreign-owned banks, and this enabled the latter to repay parent loans quickly.

The economic recovery in Lithuania has remained credit-less well into the recovery. Private sector credit growth turned positive only briefly in late 2012/early 2013 and returned back to negative growth thereafter. Yet, on the demand side, real GDP grew by 11.4 percent of GDP over the course of three years (2010–12), and real exports expanded by 48.9 percent. On the supply side, despite ongoing deleveraging, liquidity has remained high, implying funding constraints on capacity to lend have not been very strong. While the problem of household indebtedness in Lithuania was less acute (e.g. compared with Latvia), initiatives for debt restructuring and personal insolvency were also addressed with greater delay (compared with Latvia), and anecdotal evidence suggests that NPLs take much longer to resolve in Lithuania compared to other Baltic countries. Lithuania experienced a sharp internal devaluation, which led to rapid improvements in corporate profitability and savings rates, which provided alternative sources of financing to firms. Banking sector profitability was also quickly restored (by 2011), as foreign parents were able to quickly raise additional capital to absorb losses. The Central Bank introduced responsible lending regulations in late 2011 for all new loans. These limit the loan-to-value ratio to 85 percent and the debt service-to-income ratio to 40 percent.

Latvia

Our findings indicate that demand and supply for *household* credit are broadly equally important over the cycle. For households, credit demand and credit supply rose and fell more or less in tandem, reflecting equilibrium conditions (excess supply is not statistically significantly different from zero). Hence, neither demand nor supply played a dominant role in explaining credit developments. In other words, the household sector did play an important role in Latvia's boom-bust cycle—credit to households expanded somewhat more strongly compared to credit to corporates and household indebtedness problems after the 2008/09 crisis were particularly pressing (Box 8)—but this did not arise from one or another factor being more important, according to the model estimates. For instance, debt overhang affected both demand and supply for credit to households in a significant way.

For *corporate* credit, demand was more important than supply during the boom; the model points to equilibrium conditions thereafter.

- *Boom.* We find statistically significant excess supply, with actual credit to corporates constrained mainly by demand-side factors. This implies that demand played a stronger role in determining credit outcomes for corporate credit during the boom, perhaps as supply was abundantly available. This finding is consistent with the results of the panel regressions (Section II) that showed demand factors to be relatively more important during the boom. Excess credit supply disappeared toward end-2007.
- *Bust and recovery.* In the post-crisis period, demand and supply seem to move broadly in parallel, pointing to equilibrium conditions as estimated by the model. In particular, demand remains broadly flat—despite the strong rebound in economic activity—while supply rises gradually, especially towards the end of the sample period. Hence, unlike the panel results, for Latvia, there is no evidence that supply (constraints) became more important in the post-crisis period. This result is broadly consistent with a recent study of credit in the Baltic economies utilizing bank-specific data (IMF, 2014), which finds that both demand and supply factors are important in constraining credit post-crisis. On the demand side, firms have been able to finance investment internally during a period of exceptional wage restraint, while households face a considerable debt overhang. On the supply side, survey evidence for Latvia shows that banks have tightened credit standards considerably in cumulative terms since the crisis.

Box 8. Latvia

GDP per capita (US\$ PPP, 2012): 18,255

Population (2012): 2,041,763

Exchange rate regime: peg and ERM II (with euro adoption on January 1, 2014)



Latvia's credit boom was the strongest in Eastern Europe reflecting ample funding at the start and during the boom. Real credit growth averaged about 30 percent during 2003–08. Household credit, especially for mortgage lending, expanded somewhat more strongly than corporate credit (measured in change in percentage points of GDP). While Latvia benefited from the same mutually reinforcing demand and supply drivers of credit growth during the boom as other countries in the region, GDP growth ended up being accompanied by particularly high credit expansion.

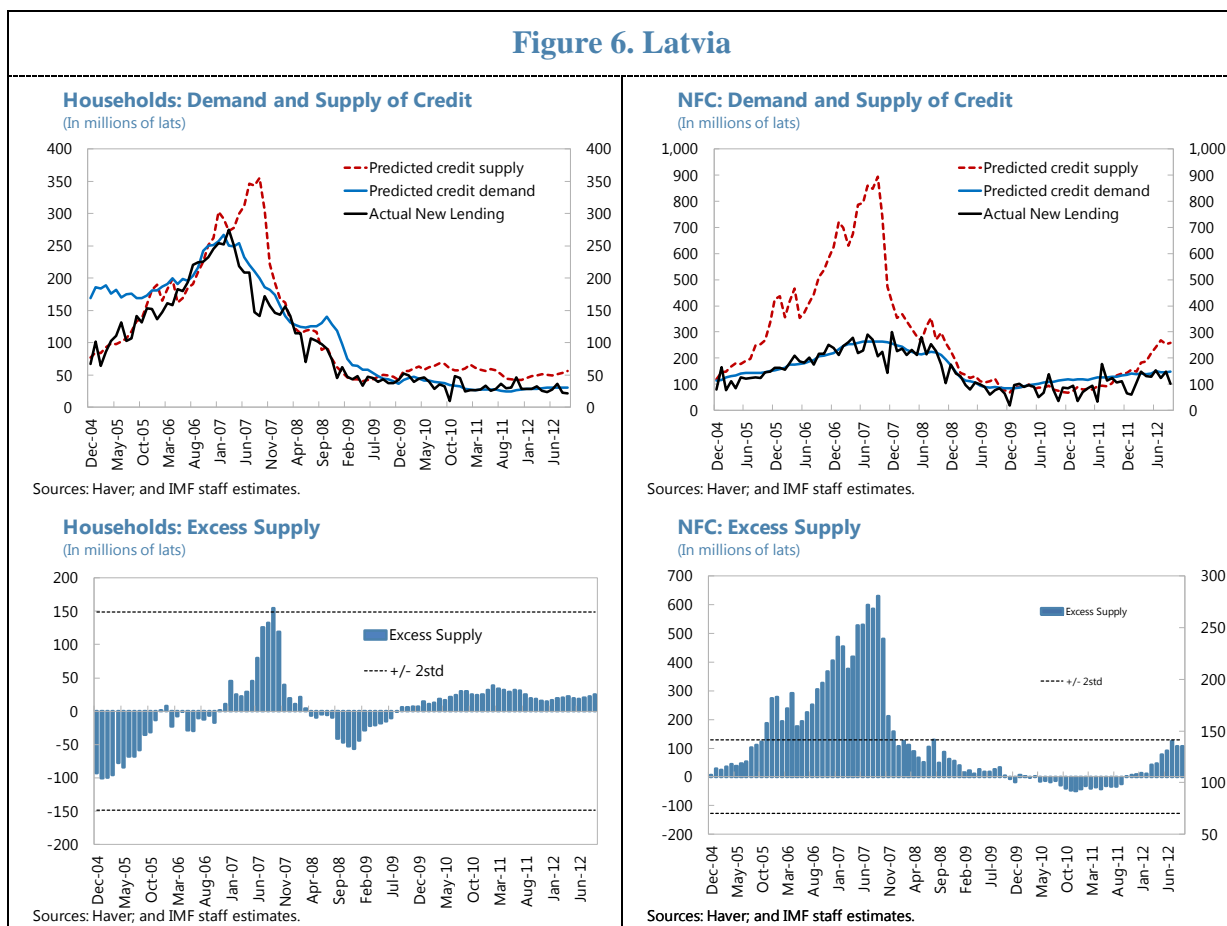
Large foreign bank inflows and traditionally high levels of non-resident deposits created exceptional availability of funding that facilitated credit expansion in Latvia. First, Latvia received exceptionally abundant parent funding. Much like Lithuania, a large share of its banking system was concentrated in foreign-owned banks (predominantly Swedish/Nordic-owned), which accounted for nearly 75 percent of the total banking sector lending to residents. The funding these banks received from their parents amounted to 45 percent of GDP at its peak, and resulted in a loan-to-deposit ratio over 270 percent in 2008. Second, non-resident deposits had been historically sizeable (they have exceeded 20 percent of GDP since 2000). As a result, Latvia started the boom with a credit-to-GDP ratio higher than its peers. During the boom, such non-resident deposits (NRDs) were *partially* channeled into domestic credit creation as well. Finally, some banks also accessed wholesale market financing. These three factors helped supplement traditional funding sources, including resident deposits. In 2007 in the context of an “anti-inflation plan”, a 90 percent limit on the loan-to-value of residential mortgages was introduced along with other requirements on real estate transactions, but it was perceived that this was too late to be effective in containing the credit boom.

Mirroring the excesses of the boom was the severity of the bust, which exposed high household indebtedness, and required sharp internal adjustment. Latvia's boom started to run out of steam by 2007—somewhat earlier than in Lithuania—perhaps because it was also more dramatic. GDP contracted as early as 2008Q1, and real credit growth (to residents) stopped growing by September 2007. The exceptional boom, the pronounced macroeconomic imbalances, and the high degree of leverage that the Latvian banking system had reached made Latvia's economy especially vulnerable to shocks. When global risk appetite tightened in the aftermath of Lehman's collapse, problems at one of Latvia's domestically-owned banks eventually led the country to seek international financial assistance and a Fund arrangement was in place from 2008–12 (see IMF, 2012). The intensity of the boom-bust cycle translated into very high household indebtedness once the crisis hit.

Both falling GDP and high NPLs suppressed both supply and demand for credit. On the supply side, while Latvia benefited from the Vienna initiative, which encouraged foreign banks to rollover exposures to their subsidiaries, parent funding decreased by 21 percent of GDP between 2008 and 2012. Further, after the breakup and liquidation of Parex bank, which traditionally channeled significant NRD funding into resident credit, and given weak domestic investment opportunities, NRDs have been increasingly diverted from domestic lending to foreign asset investment. This has further reduced the supply of credit in Latvia. With a large presence of foreign banks, the banking system was able to raise capital and absorb losses upfront such that the banking system returned to profitability by 2011.

Similarly to other sudden stops in emerging economics, Latvia's recovery was relatively fast but remained credit-less (Calvo, Izquierdo and Talvi, 2006). While the economy adjusted and real GDP growth resumed in 2009Q3, credit remained negative.

Figure 6. Latvia



This result can be interpreted in the context of Latvia's exceptional funding situation (Box 8). Latvia's boom-bust was the most pronounced in the entire CESEE region. It was facilitated by the ample availability of parent funding (which stood at 45 percent of GDP by 2008) and non-resident deposit funding during the boom. This appears to explain the excess supply of credit in the model for corporate credit. Somewhat puzzlingly, the parent funding variable in the supply equation—to the extent that it captures the health of parent banks' balance sheets—was not significant. This could be because, in the case of Latvia, aggregate credit data is insufficiently granular to identify the transmission from a shock to parent bank balance sheets via parent bank lending to local lending by the subsidiary. IMF (2014), which uses bank-by-bank data for the Baltic countries, does indeed find a link between parent bank CDS spreads and local lending.

Box 9. Latvia. Estimation Performance

- **Separate estimation for credit to NFCs and credit to households.** The reason for doing so is that, apart from data availability, credit to households and NFCs behaved somewhat differently during the boom and (to some extent) during the recovery.
- **Significance of coefficients.** Most coefficients carry the expected sign, except for the interest rate in the demand equations. In the regression for NFC credit, it has the wrong sign but is insignificant. In the regression for household credit, the interest rate in the demand equation is unexpectedly positive and significant.¹
- **Importance of debt overhang.** NPL ratio enters both the demand and supply equations. In the case of credit to NFCs, its coefficient is significantly larger in the supply equation, suggesting a stronger role of NPLs for the supply of credit to NFCs compared with the demand for credit to NFCs. However, this is the opposite for the case of credit to HH.
- **Parent funding.** While the first-step of regressing parent funding on CDS spreads of parent banks produced a good fit, in the second step, the coefficient of the fitted parent funding variable in the supply equation turned out to be insignificant. Given that the instrument for parent funding should capture funding cost pressures at the parent bank level, this suggests lack of evidence that such exogenous parent funding supply developments acted as a pull factor for credit supply.²

^{1/} One reason for the positive sign of the real interest rate coefficient in the regression for household credit could be that the perceived cost of borrowing for households might have been much lower than the one implied by the real interest rate using consumer prices as deflator (see Rosenberg and Tirpak (2008) for further discussion).

^{2/} The coefficient on parent funding was also insignificant under alternative specifications, such as the specification in which BIS flows to the region excluding Latvia were used as an instrument or in which parent funding was not instrumented but included directly (with a lag).

Poland

For Poland, the model results suggest that supply constraints were not the main factor in explaining credit expansion for either NFCs or households. The one period of exception to this finding is in the pre-crisis period for NFCs, where demand for credit appears to outpace supply of credit, which seems somewhat counter-intuitive and clearly different from the results in the panel regressions of Section II. It could reflect the fact that Poland experienced the credit boom somewhat later than other countries, and that funding was relatively more constrained in Poland than in other countries (given, for example, that parent bank funding did not expand as rapidly in Poland as it did in other countries). It could also reflect that credit *from banks* is only one source of funding for Polish corporates (see below).

Pre-crisis, demand for credit by *NFCs* appears to outpace supply of credit, the only episode of supply constraints. While the model estimates that both demand and supply for credit rose during the boom, demand remained significantly higher than supply through most of this period. This could have reflected pent-up credit demand that could not be fully met by supply. Supply constraints could have been in place because parent bank funding increased somewhat later in Poland than in the other countries, and never reached the same proportions (parent bank funding in Poland stood at 16 percent of GDP in 2008, compared with an average of 31 percent of GDP in the other four countries examined in the case studies). Also, corporate credit did not increase as much as household credit (see Box 11). An alternative possibility, however, is that the model may not have fully captured the linkages between *NFCs* and parent companies (many *NFCs* in Poland have access to loans from their own parents, as Poland is a recipient of significant FDI through its participation in the German supply chain).¹⁶ This could overstate the demand for credit *from banks*, suggesting that the supply of overall credit to the economy may not have been as constrained as the regression suggests.

Post-crisis, supply constraints disappeared for credit to *NFCs*. The rise of credit supply was halted with the onset of the 2008/09 crisis, and supply leveled off. The relative stabilization of supply—unlike in other country cases where supply dropped more sharply following the crisis—probably reflects the better cyclical position in Poland in the 2008-10 period and the fact that less imbalances needed to be unwound.¹⁷ Credit demand, however, fell, creating a period of temporary excess supply. But as this excess supply gradually disappeared, the recent period of 2011–12 has been characterized by broadly balanced credit demand and supply.

¹⁶ See IMF 2013b “German-Central European Supply Chain-Cluster Report”.

¹⁷ Parent funding was also not abruptly withdrawn, even if parents were less generous than before in rolling over existing credit lines (see Box 11). Parent funding did not enter the supply equation of credit to *NFCs*

For *household* credit, the model estimates excess supply until early 2010 and broad balance thereafter. In other words, demand for credit appears to be the most important factor constraining household credit in Poland through the boom and early crisis years. Excess supply conditions for household credit during that time coincide with supply constraints for credit to NFCs, perhaps indicating a revealed preference by banks towards lending to households and consumers—in percentage points of GDP, credit to households expanded much more than it did for corporates. After early 2010, demand and supply leveled off, broadly in tandem and with the exception of a few short-lived episodes. The leveling off of credit reflects, on the one hand, still robust growth in the mortgage segment (until mid-2012), and on the other hand, a contraction of consumer credit growth where growth has remained flat or slightly negative since late 2010. Polish households expanded consumer credit at a faster pace than other countries and this segment became quickly saturated. It was also the segment where NPLs reached the highest level, of nearly 20 percent, suggesting that supply for consumer credit may have waned as banks set about repairing this part of their balance sheets (see Box 11).¹⁸

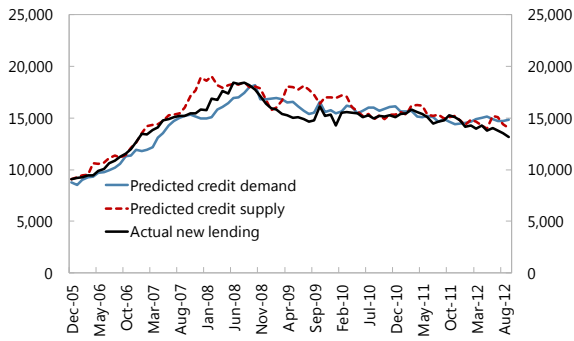
Box 10. Poland. Estimation Performance

- ***Estimation of credit to NFCs and credit to households.*** The model for Poland is estimated separately for new credit to households and new credit to NFCs. Household credit in Poland expanded particularly strongly, and mortgages in foreign exchange were prevalent (see Box 11).
- ***Significance of coefficients.*** All variables are significant, except for the lending rate in the supply equation for households and lending rates and deposit rates for NFCs. The NPL ratio is significant in both the household and NFC supply equations.
- ***Parent funding.*** The coefficient of parent funding, instrumented by CDS spread of parent banks, is significant with the predicted sign in the supply equation for credit to household. That said, the R square of the first-step OLS regression is very low.

¹⁸ The coefficient on debt overhang variables is also larger in the case of credit to households compared to credit to corporates, implying higher sensitivity of banks towards impaired household credit developments.

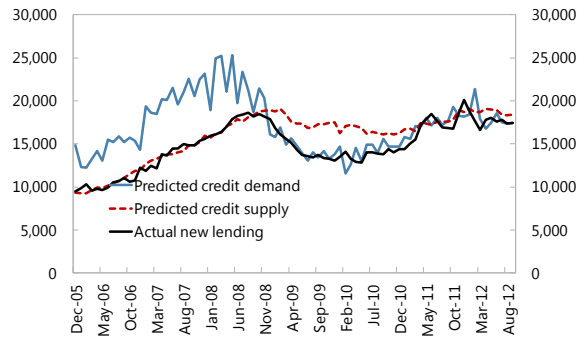
Figure 7. Poland

Households: Demand and Supply of Credit
(In millions of zloty)



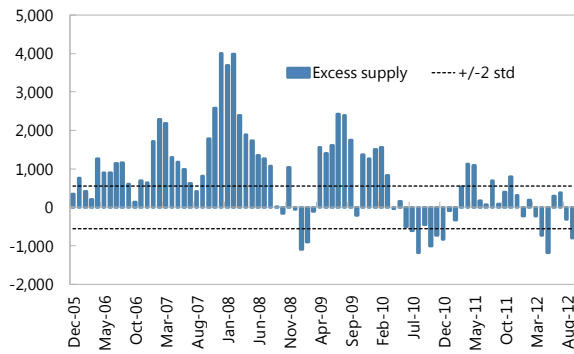
Sources: Haver, and IMF staff estimates.

NFC: Demand and Supply of Credit
(In millions of zloty)



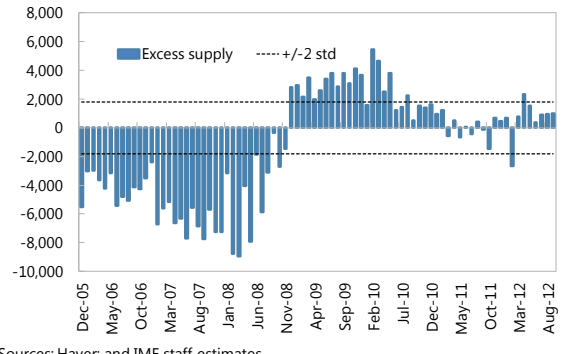
Sources: Haver, and IMF staff estimates.

Households: Excess Supply
(In millions of zloty)



Sources: Haver, and IMF staff estimates.

NFC: Excess Supply
(In millions of zloty)



Sources: Haver, and IMF staff estimates.

Box 11. Poland

GDP per capita (US\$ PPP, 2012): 20,592

Population (2012): 38,538,447

Exchange rate regime: floating



Poland avoided the excesses of many other countries in Eastern Europe, including the Baltics, amid a more moderate growth performance. Growth in Poland was steady, with relatively prudent macroeconomic policies in place, while a flexible exchange rate helped to contain inflation and maintain higher real interest rates. Credit expanded by about 20 percentage points of GDP between 2003–08 (about half of that in Lithuania and a third of that in Latvia). Moreover, credit growth accelerated relatively late, in 2007–08. Parent funding was much below that in the Baltics and geared up after 2006 (later than in other countries), coinciding with the time when credit accelerated sharply. The relatively more modest role of parent funding in Poland can be partially attributed to the larger presence of domestic banks, which had less direct access to cheap funding from parents. Other supply conditions such as profitability of the banking system and house price developments were nevertheless very similar to those elsewhere in the region.

Household credit expanded more briskly than corporate credit. Significant pent-up demand for credit by households associated with a very low base of household credit, especially mortgage credit, was met by the availability of cheap financing. By 2008, credit to households (mortgage and consumer lending) in fact exceeded corporate credit in Poland, unlike in Latvia or Lithuania. Foreign exchange mortgages, especially those denominated in Swiss franc, were very common (they reached 70 percent of the total stock of mortgage credit at peak). Still, foreign currency lending remained one of the lowest in the region, partly thanks to strict macro-prudential regulations (e.g. “Recommendation S”). Unlike in Latvia and Lithuania (non-mortgage) consumer lending played a very important role during the boom.

Poland maintained positive credit growth after 2008, but less brisk than before the crisis. While the economy slowed around the 2008/09 crisis, Poland avoided a recession in 2009 as it supported growth with strong counter-cyclical macroeconomic policies. Macroeconomic imbalances prior to the crisis had also remained contained. As a result, credit growth stayed in positive territory, in both nominal and real terms. Parent funding withdrawal was relatively contained as well. This, in part, reflects the relatively low base of parent funding, significant growth potential and strategic presence of foreign banks in Poland. Household indebtedness continued to increase over the period 2008–12. NPLs increased from a low level and have not fallen, and are particularly high for consumer credit. From 2012 onward, the credit expansion was exclusively supported by domestic funding. Macroprudential policies were further strengthened as well and focused on foreign exchange and household loans. In 2010, “Recommendation T” capped the debt service-to-income (DTI) ratio under stress scenarios at 50 percent (60 percent for above average earners). In 2011, DTI was further tightened to 42 percent for foreign exchange loans and risk weights were increased for foreign exchange mortgages and retail loans. These recommendations appear to have helped to reduce the share of foreign exchange mortgages in new mortgage lending since mid-2010.

Romania

For Romania, the model finds significant excess supply for credit to *households*; implying demand factors were the most constraining for credit expansion. This holds throughout the boom and also for the post-crisis period—the exception is a short spell of excess demand in the immediate aftermath of the crisis when supply adjusted more sharply than demand. Credit demand by households basically increased slower than supply, as supply expansion was facilitated by parent bank inflows. In a regional context, such parent bank inflows remained relatively modest (Figure 3 and Table AII.2), but the model indicates that demand factors increased more gradually than supply.

For credit to *corporates*, both demand and supply appear equally important, with the exception of one short spell. One period of excess supply is identified by the model for the period mid-2008-mid-2009. This coincides with the period of rising global uncertainty and the eventual crisis itself, and presents a mere temporary phenomenon when credit supply in Romania was still rising but demand stabilized. Indeed, the intensive scaling up of parent funding started later in Romania compared to the Lithuania or Latvia (see Box 13). For other periods, there is no statistically significant excess identified, implying that demand and supply factors contributed about equally to the credit outcomes.

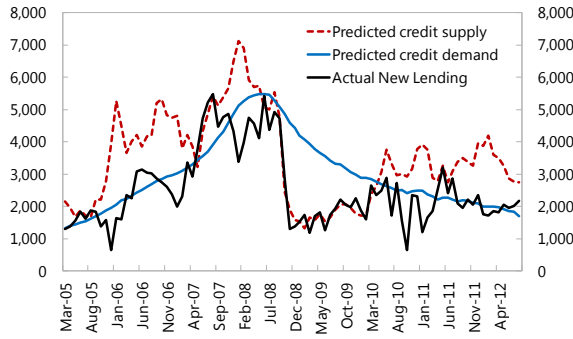
Box 12. Romania. Estimation Performance

- **Estimation of credit to NFCs and credit to households.** The model is estimated separately for credit to households and NFCs. Inflation is included in the specifications separately from the nominal lending rate—rather than including the real lending rate as a regressor—and was dropped whenever insignificant.
- **Significance of coefficients.** All variables included in the specifications are highly significant and the estimated coefficients carry the expected signs. The size of the coefficients on debt overhang variables that enter both the supply and the demand equations is of similar order of magnitude.
- **Parent funding.** The change in BIS flows to the region excluding Romania is included as a proxy for exogenous parent funding supply developments. The idea is that parent funding flows to the region would be an exogenous proxy for parent funding supply to Romania to the extent that credit demand developments in Romania are not very highly correlated with those in the rest of the region. CDS instrumentation was also tried, but the BIS flows provided a much better fit of the model. Hence, the BIS flows were used directly without any further instrumentation.

Figure 8. Romania

Households: Demand and Supply of Credit

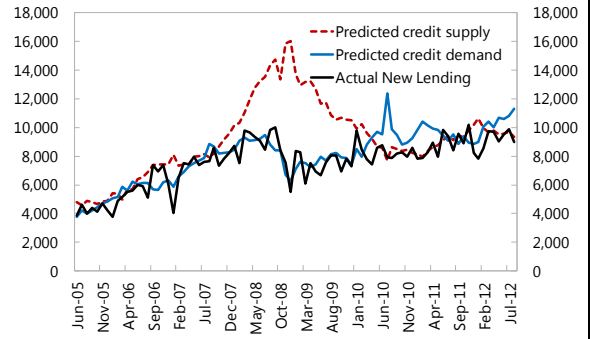
(In millions of RON)



Sources: Haver, and IMF staff estimates.

NFC: Demand and Supply of Credit

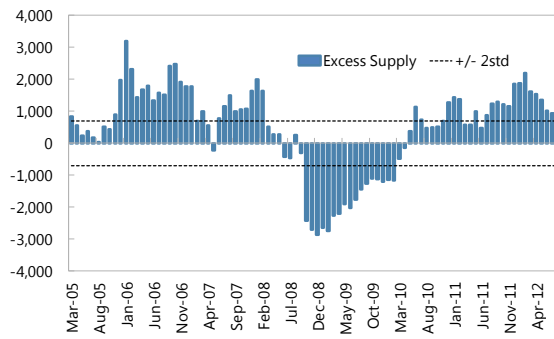
(In millions of RON)



Sources: Haver, and IMF staff estimates.

Households: Excess Supply

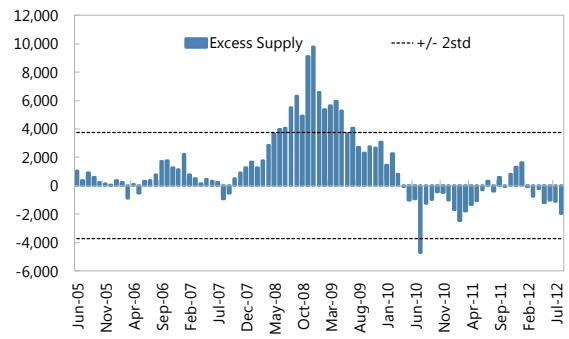
(In millions of RON)



Sources: Haver, and IMF staff estimates.

NFC: Excess Supply

(In millions of RON)



Sources: Haver, and IMF staff estimates.

Box 13. Romania

GDP per capita (US\$ PPP, 2012): 12,808

Population (2012): 21,355,849

Exchange rate regime: managed floating



Alongside strong economic growth, credit boomed from a very low base. Even though Romania entered the EU only in 2007—3 years after Poland and the Baltics—it benefited from a growth momentum similar to that in the Baltics. Growth over the period 2004–08 averaged 6.8 percent, while fiscal policy was broadly pro-cyclical.¹ Along with strong GDP growth, came very rapid credit growth, which often took the form of foreign currency lending to un-hedged borrowers. However, the credit boom started from a very low base. Credit-to-GDP amounted to only 18 percent of GDP in 2004. It increased by over 20 percentage points of GDP until 2008, yet Romania’s banking sector remained moderately sized by regional standards. Romania’s credit boom was facilitated by a major expansion in parent funding to its majority foreign-owned banking sector with parent banks located in a number of countries including, most prominently, Austria, France and Greece. Mortgage lending was negligible at the onset of the boom and remained low even by 2008, when it reached 21 percent of household credit. Household credit as a whole represented about half of total private credit at that time. To mitigate the credit boom, the authorities introduced several measures: a 75 percent loan-to-value (LTV) limit, debt service-to-income (DTI) limits of 30 percent for consumer, 35 percent for mortgage, and 40 percent for total loans, and limits to foreign currency borrowing. These measures have likely contributed to a deceleration in household credit growth, but pressure from expansionary fiscal policy and capital inflows continued to fuel the boom.

After the bust, credit growth was slightly positive, but the economy stagnated. Private sector credit continued to grow in nominal terms, albeit in real and exchange rate adjusted terms, it was negative from late 2009 to mid-2011. In addition, credit to the government expanded sharply, such that the banking sector expanded between end-2008 and end-2012 from 41.8 percent of GDP to 51.8 percent of GDP. Meanwhile, real GDP has averaged a mere 1.5 percent in 2011–12 after falling by 7.8 percent in 2009/10. Hence, the recovery has been weak. Parent loans at end-2012 were 22 percent below their pre-crisis peaks. This relatively moderate decline can be partially explained by the fact that, like Latvia, Romania formally benefited from the Vienna initiative early in the crisis, and by the fact that it reflects parent banks’ longer-term strategic presence in a market with significant growth potential. However, parent bank retrenchment picked up pace in 2012 as the recovery disappointed and NPLs continued to rise.² The large share of foreign currency lending, combined with periods of depreciation pressures also compounded the debt overhang problem. In the bust, the authorities removed the maximum limits imposed for LTVs and DTIs and transferred the responsibility of establishing such criteria to creditors subject to guidelines.

¹ Monetary tightening was largely ineffective in the light of pro-cyclical fiscal policy and large capital inflows.

² Even if such NPLs are mostly 100 percent provisioned for.

Table 2. Determinants of Credit Demand and Supply in Disequilibrium Model

	Montenegro	Lithuania	Latvia		Poland		Romania	
			NFCs	HHs	NFCs	HHs	NFCs	HHs
Credit demand								
Constant	4.33***	-4.18***	4.42***	5.18***	2.52***	6.31***	-23.82***	-50.49***
Cost of credit (lending rate)	-0.04	-0.06***	0.003	0.05***	-0.007	-0.02***	-0.08***	-0.03***
Inflation	..	..	..	..	..	..	12.61***	..
Economic conditions								
- economic sentiment index	..	0.13	0.02***	..	..	..	..	..
- stock exchange	..	0.001***	..	..	..	0.0009***	..	..
- real GDP	..	..	..	..	..	..	2.93***	4.72***
- uncertainty	..	-0.01***	..	..	..	..	..	..
- new orders	0.33***	0.008***	..	..	..	..	..	..
- unemployment	..	-0.07***	..	..	..	-0.09***	..	..
- wages	..	..	..	..	..	..	..	..
- wage bill	..	..	..	7.67*	..	..	..	..
- consumer financial situation	..	..	..	..	..	..	..	..
- industrial production	..	..	..	..	2.96***	..	..	..
Debt overhang	-0.01***	..	-0.02***	-0.13***	..	..	-0.05***	-0.19***
Alternative funding								
- profitability/productivity	..	..	-0.02***	..	-0.04***	..	-2.41**	..
- financial constraints index	..	0.56***	..	..	..	..	..	..
Other								
- tourist arrival	0.01***	..	..	..	..	..	..	..
- retail index	0.01***	..	..	..	..	..	..	..
- gross profit margin	..	0.36***	..	..	..	..	..	..
Credit supply								
Constant	3.77***	-1.68***	2.82*	1.93***	0.59	4.70***	-10.19***	-90.46***
Return on credit (lending rate)	0.08***	0.01***	0.086	0.05***	0.06	0.006	0.17***	0.67***
Inflation	..	..	..	..	..	..	-5.23**	..
Economic conditions								
- economic sentiment index	..	0.34***	..	..	..	..	..	..
- stock exchange	..	0.002***	0.004*	0.003***	..	..	..	..
- real GDP	..	..	..	..	..	..	0.90***	6.2***
- real estate prices	..	..	..	..	..	..	..	..
Debt overhang/creditworthiness	-0.07***	-0.15***	-0.11***	-0.06***	-0.05***	-0.08***	-0.05***	-0.15***
Funding costs/financial stress								
- local spread over euribor	-0.005	..	..	..	..	..	..	..
- banks' interest margin	..	0.02***	..	..	..	..	..	..
- deposit rate	..	..	..	..	-0.05	-0.06***	-0.04*	-0.33***
- Swiss franc libor	..	..	..	..	..	..	..	..
- measure of counterparty risk	..	..	..	..	..	..	..	..
Lending capacity								
- deposits	1.19***	0.21***	0.005	0.006***	0.55***	0.08**	..	..
- leverage from excess capital	..	..	..	..	..	..	0.34***	2.79***
- parent bank funding (fitted)	0.29***	0.52***	-0.38	0.2	..	0.004***	..	..
- flows of BIS reporting banks to region	..	..	..	..	..	..	..	5.82***
Other								
- Snoras dummy	..	-0.09***	..	..	..	..	..	..
- lending survey	..	..	..	..	..	..	-0.01***	..
Regression statistics								
Number of observations	72	75	94	94	82	82	92	92
Number of iterations	178	139	91	88	73	160	69	45
Log likelihood	82.0	232.1	9.6	23.4	125.7	196.3	96.1	0.5
Parent funding instrumentation								
Constant	515.26***	0.035***	137.53***	..	..	16.7***	..	..
Instrumentation variable								
- CDS of parent banks	..	-0.0003***	-1.32***	..	..	-0.07***	..	..
- CDS of sovereign	..	..	..	..	..	..	..	..
- France	-6.21***	..	..	..	..	..	..	..
- Austria	-0.79	..	..	..	..	..	..	..
- Hungary	3.03***	..	..	..	..	..	..	..
Number of observations	75	75	99	..	..	107	..	..
R(2)	0.67	0.46	0.38	..	..	0.07	..	..

Source: IMF staff estimates.

***, **, and * indicate a p-value lower than 1 percent, 5 percent, and 10 percent respectively.

IV. CONCLUSION

Credit supply and demand moved in tandem before and during the crisis, reflecting a classic boom and bust cycle. Both the panel regressions and disequilibrium models used in the case studies suggest that both demand and supply factors are significant in explaining credit growth. Moreover, the disequilibrium models used in the country case studies show that estimated demand and supply both rose during the boom and subsequently fell during the bust. As such, the initial fast rise and recent slowdown in credit reflects both demand and supply factors.

We also find that, on average for the region, supply factors became more important after the crisis, but that country experiences differed.

- The panel analysis suggests that after the crisis hit (during 2008–11), the size of the coefficient explaining the responsiveness of credit growth to domestic demand fell while the size of the coefficients on factors that are related to supply only—bank solvency, asset quality, and loan-to-deposit ratios—became more pronounced. This points to a relative shift in importance between demand and supply factors, with supply factors becoming relatively more important, on average, in the post-crisis period in countries in Central and Eastern Europe.
- However, in the five country case studies, we find that country experiences also differed. Much like the panel results, demand factors were the most important for explaining the evolution of credit during the *boom* (for corporate credit in Latvia and for household credit in Poland and Romania). Similarly, we find some evidence that supply constraints became binding in the *post-crisis* period, but only for Lithuania and Montenegro.

Country heterogeneity points to differences in the peculiarities of countries' boom-bust cycle. While demand and supply both rose and fell in nearly all countries, the intensity of the credit and economic cycles also varied widely. For instance, Latvia and Lithuania both experienced a credit and economic boom, but Lithuania's credit boom was more contained, whereas funding conditions in Latvia were exceptionally abundant.

Several policy implications can be drawn from the results.

- The first is related to external funding. The crisis has highlighted the importance of averting sudden stops to external funding. In this regard, multilateral coordination (such as the Vienna Initiative) and strong home-host cooperation are critical tools. Banks too have a role to play by improving the management of their funding operations and diversifying their funding structure to reduce their vulnerability to sudden stops.
- The second is related to dealing with debt overhangs and asset quality. The results of both the cross-country exercise and the case studies show that impaired loans can be a

significant drag on credit expansion. In this regard, proactive actions by banks to dispose impaired loans, supported by improvements in legal framework, tax system, and judicial system that provide the right incentives and facilitate the disposal and resolution of problem loans remains crucial to support credit expansion and economic growth (European Banking Coordination “Vienna” Initiative, 2012).

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Appendix I. Data Used in the Panel Regression

Table AI.1. Country Distribution of the Sample

Country	Domestic banks	Foreign banks	Total	Country	Domestic banks	Foreign banks	Total
Albania	10	46	56	Macedonia, FYR	46	41	87
Belarus	42	37	79	Moldova	58	14	72
Bosnia & Herzegovina	52	80	132	Montenegro, Rep. of	17	25	42
Bulgaria	71	76	147	Poland	31	97	128
Croatia	174	105	279	Romania	40	128	168
Czech Republic	20	107	127	Serbia, Republic of	74	73	147
Estonia	17	20	37	Slovak Republic	11	101	112
Hungary	16	46	62	Slovenia	63	43	106
Latvia	86	63	149	Turkey	66	59	125
Lithuania	44	46	90	Ukraine	167	103	270
Total	1105	1310	2415				

Sources: Bankscope and IMF staff estimates.

Table AI.2. Time Distribution of the Sample

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
No. of obs. for domestic banks	85	90	96	102	107	107	105	102	109	106	96	1105
No. of obs. for foreign banks	44	52	65	75	101	126	148	161	171	187	180	1310
Total	129	142	161	177	208	233	253	263	280	293	276	2415

Sources: Bankscope, and IMF staff estimates.

Table AI.3. Summary Statistics of Data 1/

Variable	No. of observations	Mean	Standard deviation	Min	Max
Growth of gross loans (%)	2415	21.9	37.1	-54.2	345.5
EMBIG spread (pp)	2415	392.1	164.4	197.1	796.4
Real domestic demand growth (percent)	2415	4.1	8.1	-27.4	24.2
Average inflation (percent)	2415	6.5	7.3	-1.2	80.6
Bank size (% of host country GDP, 1st lag)	2415	3.8	5.5	0.0	43.4
Reserves to gross loan ratio (% , 1st lag)	2415	5.6	5.2	0.0	41.9
Net loans to customer deposits ratio (% , 1st lag)	2415	109.0	74.9	12.9	679.1
Liquidity to dep. & st funding ratio (% , 1st lag)	2415	38.2	22.9	1.3	246.8
Equity to net loans ratio (% , 1st lag)	2415	27.3	21.7	0.9	215.7
Return on average equity (% , 1st lag)	2415	8.4	15.1	-99.1	75.7
Parent equity to total assets ratio (%)	988	6.3	4.9	-85.8	40.5
Parent bank home country CDS spreads	988	99.8	134.5	0.0	812.4

1/ Summary statistics of parent bank variables are only reported for foreign bank observations included in the regressions with those variables.

Sources: Bankscope; and IMF staff estimates.

Appendix II. Case Study Summary Statistics and Narratives

Table AII.1. Summary Indicators (percent)

	Montenegro		Lithuania		Latvia		Poland		Romania	
	2004-08	2009-12	2004-08	2009-12	2004-08	2009-12	2004-08	2009-12	2004-08	2009-11
Average real GDP growth	7.0	-0.1	7.1	-1.2	7.3	-1.9	5.4	3.0	6.8	-1.9
Average inflation	4.8	2.8	4.9	3.2	9.0	2.1	2.8	3.4	8.0	5.8
Average nominal credit growth	..	-8.1	42.2	-5.4	41.9	-8.3	22.5	7.5	48.6	3.4
Average real credit growth	..	-10.9	37.3	-8.5	30.8	-10.1	19.2	3.9	39.4	-1.7
Average nom. exch. rate change (+ = appr)	peg	peg	peg	peg	peg	peg	3.0	0.7	0.7	-4.7

Source: Authorities and Fund staff calculations.

Table AII.2. Banking sector indicators (end-year values)

	Montenegro			Lithuania			Latvia			Poland			Romania		
	2006	2008	2012	2003	2008	2012	2003	2008	2012	2003	2008	2012	2003	2008	2012
Size of banking sector (% of GDP)															
Banking sector assets	..	63.0	62.7	38.9	81.9	74.4	89.7	144.5	130.3	58.4	82.2	85.8	..	72.7	68.9
Credit stock 4/	38.5	89.3	56.3	21.0	60.9	48.3	47.1	103.1	75.6	26.6	47.2	50.1	17.7	41.8	51.9
o/w: mortgages 5/	..	..	..	5.5	18.7	19.1	7.6	31.4	24.1	3.6	15.6	20.9	..	4.1	6.3
Deposit stock	38.8	47.0	46.2	25.3	34.6	43.4	58.6	60.7	80.4	36.6	44.8	50.6	..	28.8	32.4
o/w: non-resident deposits 3/	..	..	..	..	..	..	31.4	21.5	37.1	..	..	..	..	..	..
o/w: resident deposits 3/	..	..	..	..	..	..	27.2	39.1	43.3	..	..	..	..	..	..
Parent loans 2/	7.3	26.9	10.6	7.3	35.4	18.1	9.0	44.9	23.9	5.6	16.5	13.7	1.2	17.8	15.6
Structure of banking sector (share, in percent)															
Forex deposits in total deposits 4/	..	..	..	30.1	30.2	31.6	69.6	69.4	76.2	16.2	9.7	9.3	41.2	35.6	36.7
Forex lending in total lending 4/	..	..	..	47.9	62.5	68.9	60.6	89.5	88.0	31.3	33.8	30.9	57.7	53.2	46.3
Lending to households in total	..	..	..	27.7	42.5	46.5	25.3	39.6	40.2	43.7	62.1	67.0	..	43.9	31.2
Mortgage lending in total credit 5/	..	..	..	19.4	30.7	39.5	16.2	30.5	31.9	13.7	33.0	41.6	..	9.7	12.2
Non-mortgage HH lending in total 5/	..	..	..	8.2	11.9	7.0	9.0	9.1	8.3	30.0	29.1	25.3	..	34.2	19.0
Concentration (share of largest 5) 1/															
By assets	..	87.0	57.0	..	75.0	..	63.1	69.5	62.8	52.3	44.6	44.9	63.9	54.3	55.2
By loans	..	..	..	..	75.0	..	73.4	74.5	74.2	59.0	55.3	44.2	57.1	53.3	0.0
Degree of foreign ownership															
By assets of foreign-owned banks 6/	58.8	71.7	74.0	..	86.0	..	..	62.6	62.5	67.8	72.3	63.6	58.2	88.2	81.2
By loans of foreign-owned banks 6/	64.0	73.1	74.5	..	87.5	..	..	70.7	75.9	..	71.7	..	..	..	0.0
Other indicators (percent)															
Real lending rate	7.8	0.4	5.9	..	-5.2	0.1	0.0	1.3	1.8	...	7.3	5.3	11.3	8.7	8.3
NPL ratio	..	7.2	16.9	..	4.6	13.9	...	3.6	11.1	21.2	4.4	8.9	...	2.8	18.2
Loan-to-deposit ratio 4/	78.9	140.6	98.5	..	187	121	143.2	273.4	174.9	77.9	120.0	110.2	77.2	142.2	154.5

1/ For Lithuania, share of largest 4.

2/ Gross external debt of credit institutions for Poland and Romania and Montenegro.

3/ Not from related MFIs, i.e. excluding parent loans.

4/ For Romania, 2004 data.

5/ 2004 data for Lithuania.

6/ 2009 data instead of 2008 data for Latvia.

Appendix III. Description of Variables of Disequilibrium Model

	Montenegro	Lithuania	Latvia	Poland	Romania
Dependent variable	<ul style="list-style-type: none"> • <u>new credit flow</u> in real terms • monthly data • in logs • flow data constructed from monetary survey data using the maturity structure of existing credit • six month moving average • deflated using HICP 	<ul style="list-style-type: none"> • <u>new credit flow</u> in real terms • monthly data • in logs • flow data from BoL • six-month moving average of seasonally adjusted series to smooth data • deflated using HICP 	<ul style="list-style-type: none"> • <u>new credit flow</u> in real terms • monthly data • in logs • flow data constructed from monetary survey data using the maturity structure of existing credit; adjusted for write-offs and the removal of liquidated banks from the statistics • deflated using HICP 	<ul style="list-style-type: none"> • <u>new credit flow</u> in real and foreign exchange adjusted terms • monthly data • in logs • flow data constructed from monetary survey data using assumptions of the amortization based on the original maturity of credit stock • computed at constant exchange rates, assuming that all foreign currency denominated household credit is in Swiss franc, and that all foreign currency denominated corporate credit is in euro • 3-month moving average of seasonally adjusted series to smooth data • deflated using HICP 	<ul style="list-style-type: none"> • <u>new credit flow</u> in real terms • monthly data • in logs • flow data constructed from monetary survey data including both local currency and foreign exchange credit • flow data are computed at constant exchange rates, using the maturity structure of existing credit. • deflated using HICP
<u>Credit demand equation</u>	<u>From households and NFC</u>	<u>From households and NFC</u>	<u>From NFC</u>	<u>From NFC</u>	<u>From NFC</u>
Cost of Credit	<ul style="list-style-type: none"> • <u>average lending rate</u>, real terms, deflated by HICP • negative and significant 	<ul style="list-style-type: none"> • <u>lending rate</u> on new loans, constructed as the weighted average of loans in litas and euro), real terms, 	<ul style="list-style-type: none"> • <u>Lending rate</u> on new loans to non-financial corporates (in percent) • Constructed as the weighted average of loans in lats and in 	<ul style="list-style-type: none"> • <u>lending rate</u> for new zloty corporate loans, in real terms, deflated by HICP • positive and insignificant 	<ul style="list-style-type: none"> • <u>lending rate</u> to corporate, weighted by currency of denomination of credit, nominal terms, average lending rate • negative and

		<ul style="list-style-type: none"> deflated by HICP negative and significant 	<p>euros (due to data availability, data were used for lending up to 0.25 million euro and up to 1 year; correlation with other lending rates that are available at lower frequency was very high)</p> <ul style="list-style-type: none"> real terms, deflated by HICP positive and insignificant 		<ul style="list-style-type: none"> significant <u>inflation rate</u>, percent change in CPI compared with previous month; (inflation is very volatile in Romania, and the model performed poorly using the real lending rate; hence, inflation is included separately) positive and significant
Economic conditions	<ul style="list-style-type: none"> <u>tourist arrivals</u>, y-o-y change, six months average positive and significant <u>construction new orders</u>, six months average positive and significant <u>retail sales</u>, six months average positive and significant 	<ul style="list-style-type: none"> <u>economic confidence</u> indicator, one month lagged positive and insignificant real change in <u>Vilnius stock exchange index</u>, one month lagged positive and significant weighted average of <u>volatility of consensus forecasts</u> for Lithuania's major trading partners, to proxy for 	<ul style="list-style-type: none"> <u>economic sentiment</u> indicator (index, seasonally adjusted, Eurostat) positive and significant 	<ul style="list-style-type: none"> <u>industrial production</u>, in real terms, deflated by HICP, seasonally adjusted series, one month lagged positive and significant 	<ul style="list-style-type: none"> linearly interpolated seasonally adjusted <u>real GDP growth</u>, as a proxy for expectations positive and significant other indicators such as industrial production, employment, and various survey indicators proved a poor fit to the model and were dropped

		<p>uncertainty, lagged one month</p> <ul style="list-style-type: none"> • negative and significant • <u>industry new orders</u>, lagged by one month, seasonally adjusted series • positive and significant • <u>unemployment</u>, lagged one month, seasonally adjusted series • negative and significant 			
Debt overhang	<ul style="list-style-type: none"> • <u>credit to GDP ratio</u>, change in six months • negative and significant 		<ul style="list-style-type: none"> • <u>NPL ratio</u> for corporate loans, monthly data since September 2008, quarterly data were used before that and interpolated • negative and significant 	<ul style="list-style-type: none"> • <u>NPL ratio</u> on corporate lending, one month lagged • negative and significant 	<ul style="list-style-type: none"> • share of <u>debts past due in total loans</u> • negative and significant
Alternative funding		<ul style="list-style-type: none"> • <u>business survey</u> indicator on whether firms are financially constraint, lagged one month • positive and significant 	<p><u>Profitability index</u> in the private sector (all sectors excluding public administration, education and social work); constructed as real labor productivity divided by real wages;</p>	<ul style="list-style-type: none"> • <u>difference between productivity growth and real wage growth</u> in the private sector, as a proxy for growth in return on capital or profitability, one month lagged • negative and significant 	<ul style="list-style-type: none"> • <u>productivity growth</u> (the ratio of real GDP to employment) • negative and significant

			<p>quarterly data were interpolated to obtain monthly frequencies</p> <ul style="list-style-type: none"> • negative and significant 		
Other		<ul style="list-style-type: none"> • gross <u>profit margin</u> of firms, lagged one month profitability to measure prospects for business expansion • positive and significant 			
			<u>From households</u>	<u>From households</u>	<u>From households</u>
Cost of credit			<ul style="list-style-type: none"> • <u>Lending rate</u> on new loans to households; constructed as the weighted average of housing and other loans in lats and in euros, in real terms, deflated by HICP • positive and significant 	<ul style="list-style-type: none"> • <u>lending rate</u> on new zloty household credit, in real terms • negative and significant • Swiss Franc Libor rate, in real terms • positive and significant 	<ul style="list-style-type: none"> • average <u>lending rate</u> to households weighted by currency, nominal terms (inflation was insignificant and hence dropped) • negative and significant
Economic conditions			<ul style="list-style-type: none"> • Percentage change (mom) in <u>compensation of employees</u>; seasonally adjusted series, <u>in real terms (deflated by HICP)</u>; <u>quarterly data were interpolated to obtain</u> 	<ul style="list-style-type: none"> • real change in <u>Warsaw stock exchange index</u>, one month lagged • positive and significant • <u>unemployment rate</u>, one month lagged, one month lagged, in seasonally adjusted terms • negative and significant 	<ul style="list-style-type: none"> • linearly interpolated seasonally adjusted <u>real GDP growth</u> • positive and significant • other proxies such as industrial production, employment or various survey

			<ul style="list-style-type: none"> <u>monthly frequencies</u> <u>significant and positive</u> 		indicators yielded a worse fit and were dropped; variables to proxy income prospects such as wage and employment growth were not significant and were dropped as well
Debt overhang			<ul style="list-style-type: none"> <u>NPL ratio</u> for household lending; monthly data since September 2008, quarterly data before that were interpolated to obtain monthly frequencies negative and significant 		<ul style="list-style-type: none"> <u>share of debts past due</u> in total lending negative and significant
<u>Credit supply equation</u>	<u>For households and NFC</u>	<u>For households and NFC</u>	<u>For NFC</u>	<u>For NFC</u>	<u>For NFC</u>
Return on credit	<ul style="list-style-type: none"> <u>average lending rate</u>, real terms, deflated by HICP positive and significant 	<ul style="list-style-type: none"> <u>lending rate</u> on new loans, constructed as the weighted average of loans in litas and euro), real terms, deflated by HICP positive and significant 	<ul style="list-style-type: none"> <u>Lending rate</u> on new loans to non-financial corporate; constructed as the weighted average of loans in lats and in euros (due to data availability, data were used for lending up to 0.25 million euro and up to 1 year, correlation with other lending rates that are available at lower 	<ul style="list-style-type: none"> <u>lending rate</u> for new zloty loans, in real terms, deflated by HICP positive and insignificant 	<ul style="list-style-type: none"> <u>lending rate</u>, average rate, nominal terms positive and significant <u>inflation</u>, percent change in CPI compared with previous month inflation is very volatile in Romania, and the model performed poorly using the real lending rate; hence, inflation is

			<p>frequency was very high),real terms, deflated by HICP</p> <ul style="list-style-type: none"> • positive and significant 		<p>included separately</p> <ul style="list-style-type: none"> • negative and significant
Economic conditions		<ul style="list-style-type: none"> • <u>economic confidence</u> indicator, one month lagged • positive and significant • real change in <u>Vilnius stock exchange index</u>, one month lagged • positive and significant 	<ul style="list-style-type: none"> • <u>stock exchange</u> index • positive and significant 		<ul style="list-style-type: none"> • linearly interpolated seasonally adjusted <u>real GDP growth</u>, as a proxy for expectations • positive and significant
Debt overhang/ Credit worthiness	<ul style="list-style-type: none"> • <u>NPL ratio</u>, six month average, lagged • negative and significant 	<ul style="list-style-type: none"> • <u>NPL ratio</u> (aggregate), one month lagged • negative and significant 	<ul style="list-style-type: none"> • <u>NPL ratio</u> for corporate loans, monthly data since 2008, quarterly data were used before 2008 and interpolated • negative and significant 	<ul style="list-style-type: none"> • <u>NPL ratio</u> for corporate loans, one month lagged • negative and significant 	<ul style="list-style-type: none"> • <u>share of overdue loans in total lending</u> • negative and significant
Funding cost/ Financial stress	<ul style="list-style-type: none"> • <u>lending rate margin over Euribor</u>, percent change • negative, insignificant 	<ul style="list-style-type: none"> • <u>interest margin</u>, calculated as lending rate minus funding costs. Funding costs calculated as the weighted average of litas and euro deposit rate and cost of external funding 	<ul style="list-style-type: none"> • several measures of <u>interest rate margin</u> were not significant and was therefore dropped 	<ul style="list-style-type: none"> • <u>deposit rate</u> on zloty deposits, in real terms, deflated by HICP • negative and insignificant 	<ul style="list-style-type: none"> • <u>deposit rate</u> weighted average by currency • negative and significant

		<p>from parent banks. Cost of external funding from parent banks is proxied by 12m EURIBOR rate plus CDS of Sweden and Lithuania.</p> <ul style="list-style-type: none"> • positive and significant 			
Lending capacity	<ul style="list-style-type: none"> • <u>domestic deposits</u>, six month average, deflated, lagged • positive and significant • <u>Banks' foreign liabilities</u>, six month average, deflated, lagged, instrumented with sovereign CDS spreads • positive and significant 	<ul style="list-style-type: none"> • <u>domestic deposits</u>, lagged, seasonally adjusted series, in logs • positive and significant • <u>parent funding</u>, lagged one month (First order difference in parent funding was instrumented with the CDS spread of SEB bank (the only parent with CDS available with long enough series), Then the fitted value of stock of parent funding (backed up using the fitted values for 	<ul style="list-style-type: none"> • <u>Deposits deflated by HICP</u> • <u>Positive and insignificant</u> • The change in <u>parent funding</u> was instrumented with the CDS spread of SEB bank; the moving average over the last 3 months of fitted change in parent funding deflated by HICP was included in the supply equation • negative and insignificant • The <u>CDS spreads for SEB bank</u> was used as a proxy for funding costs of parent banks as it goes back to 2004 and is highly correlated with CDS of other parent banks 	<ul style="list-style-type: none"> • <u>domestic deposits</u> minus banks' reserves at the Polish central bank, in real terms, deflated by HICP, in logs • positive and significant 	<ul style="list-style-type: none"> • <u>bank capital divided by minimum capital requirements</u>, in real terms • positive and significant • (Different measures of flows from BIS reporting banks to the CEE region as a proxy for availability of external funding was tried, but was not significant in most specifications and hence dropped)

		<p>difference in parent funding) was included in the supply function), in real terms, deflated by HICP, in logs, seasonally adjusted series</p> <ul style="list-style-type: none"> • positive and significant 	<p>such as Swedbank or Nordea.</p>		
Other		<ul style="list-style-type: none"> • <u>Dummy</u> =1 from 2011 M11 onward to capture the bankruptcy of Snoras bank, and hence, its removal from the statistics 			<ul style="list-style-type: none"> • <u>lending survey</u> on the percentage of respondents that identify constraints to obtaining financing as a significant factor limiting production. • Negative and significant
			<u>For households</u>	<u>For households</u>	<u>For households</u>
Return of credit			<ul style="list-style-type: none"> • <u>Lending rate</u> on new loans (in percent), <u>constructed</u> as the weighted average of housing and other loans in lats and in euros, real terms, deflated by HICP • positive and significant 	<ul style="list-style-type: none"> • <u>lending rate</u> on new zloty household credit, in real terms, deflated by HICP • positive and significant 	<ul style="list-style-type: none"> • <u>lending rate</u>, average, nominal • positive and significant • (Inflation was insignificant and hence dropped)
Economic			<ul style="list-style-type: none"> • <u>stock exchange index</u> • positive and significant 	<ul style="list-style-type: none"> • <u>expected business situation in the retail sector</u>, seasonally adjusted 	<ul style="list-style-type: none"> • linearly interpolated seasonally adjusted <u>real GDP growth</u>, as a

conditions				<ul style="list-style-type: none"> • positive and significant 	<ul style="list-style-type: none"> • proxy for expectations • positive and significant • (other variables such as industrial production, employment and various survey indicators produced a poorer fit to the model and were dropped)
Debt overhang/ Credit worthiness			<ul style="list-style-type: none"> • <u>NPL ratio for households</u>, monthly data since September 2008, before that quarterly data were interpolated • negative and significant 	<ul style="list-style-type: none"> • <u>NPL ratio on household loans</u>, one month lagged • negative and significant 	<ul style="list-style-type: none"> • <u>share of overdue loans in total</u> • negative and significant
Lending capacity			<ul style="list-style-type: none"> • <u>deposits</u> deflated by HICP • positive and significant • The change in <u>parent funding</u> was instrumented with the CDS spread of SEB bank; the moving average over the last 3 months of fitted change in parent funding deflated by HICP was included in the supply equation • positive and insignificant • The <u>CDS spreads for</u> 	<ul style="list-style-type: none"> • <u>domestic deposits</u> minus banks' reserves at the central bank, 4-month lagged, in real terms, deflated by HICP, in logs • positive and significant • <u>external funding</u>, lagged one month, first order difference in external funding was instrumented with the CDS spread of parent banks, then the fitted value of stock of parent funding (backed up using the fitted values for difference in external funding) was included in the supply function • positive and significant 	<ul style="list-style-type: none"> • <u>bank capital divided by minimum capital requirements, in real terms</u> • positive and significant • <u>flows from BIS reporting banks to countries in the CEE region</u> as a proxy for availability of external funding (percent change in flows in US\$) • positive and significant

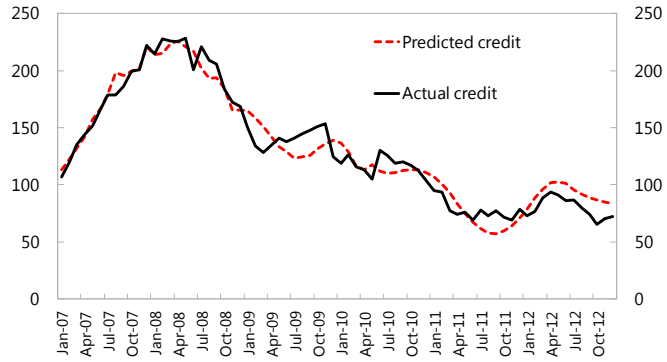
			<u>SEB bank</u> was used as a proxy for funding costs of parent banks as it goes back to 2004 and is highly correlated with CDS of other parent banks such as Swedbank or Nordea.		
Funding costs/ Financial stress				<ul style="list-style-type: none"> • <u>real deposit rate on new deposits</u> • negative and significant • other indicators, such as WIBOR-OIS spread and CIRS rate turn out to be insignificant 	<ul style="list-style-type: none"> • <u>deposit rate</u>, average, nominal • negative and significant
<u>Sample period</u>	2007M1–2012M12	2006M10–2012M10	2004M12–2012M9	2005M12–2012M9	2005M1–2012M8

Appendix IV. Fit of Model ¹⁹

Montenegro

Actual and Predicted Credit

(In millions of Euro)

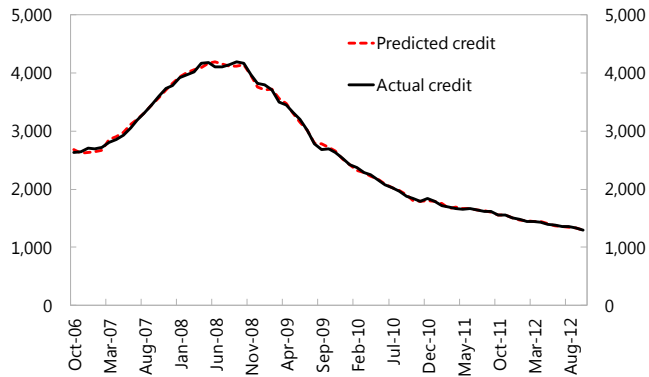


Sources: Haver; and IMF staff estimates.

Lithuania

Actual and Predicted Credit

(In millions of litai)

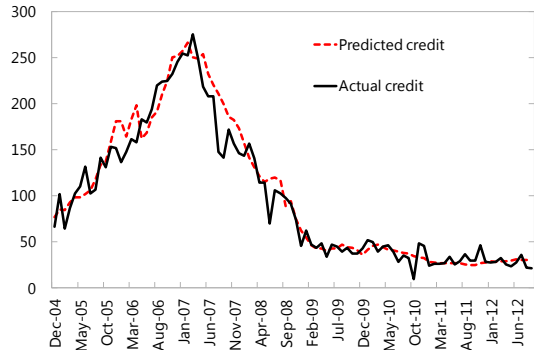


Sources: Central Bank of Lithuania; Haver; and IMF staff estimates.

¹⁹ While the models are usually estimated using data on real credit, the figures in Appendix IV report actual and fitted credit in nominal terms.

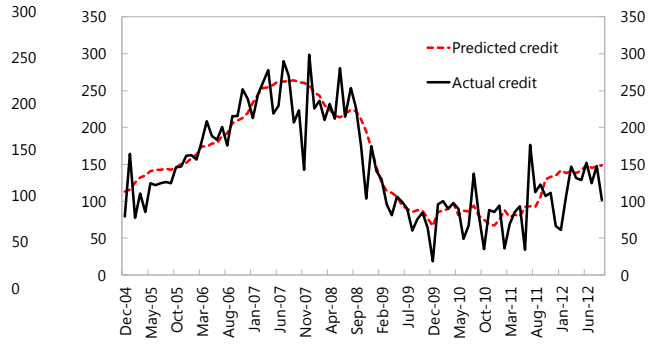
Latvia

Households: Actual and Predicted Credit
(In millions of lats)



Sources: Haver, and IMF staff estimates.

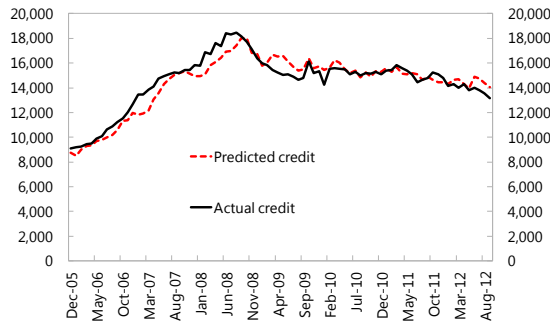
NFC: Actual and Predicted Credit
(In millions of lats)



Sources: Haver, and IMF staff estimates.

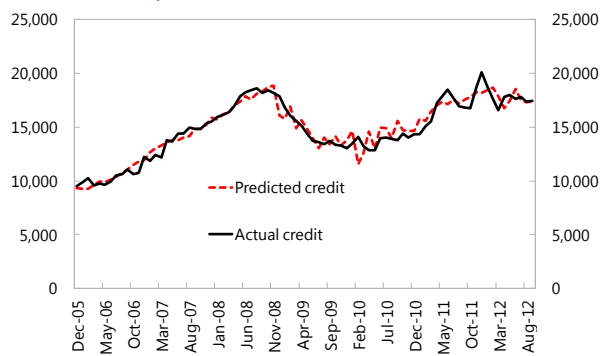
Poland

Households: Actual and Predicted Credit
(In millions of zloty)



Sources: Haver, and IMF staff estimates.

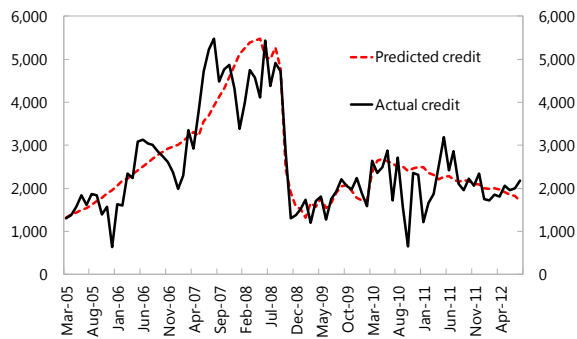
NFC: Actual and Predicted Credit
(In millions of zloty)



Sources: Haver, and IMF staff estimates.

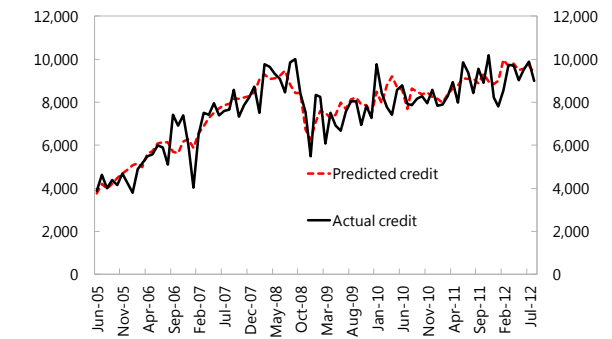
Romania

Households: Actual and Predicted Credit
(In millions of RON)



Sources: Haver, and IMF staff estimates.

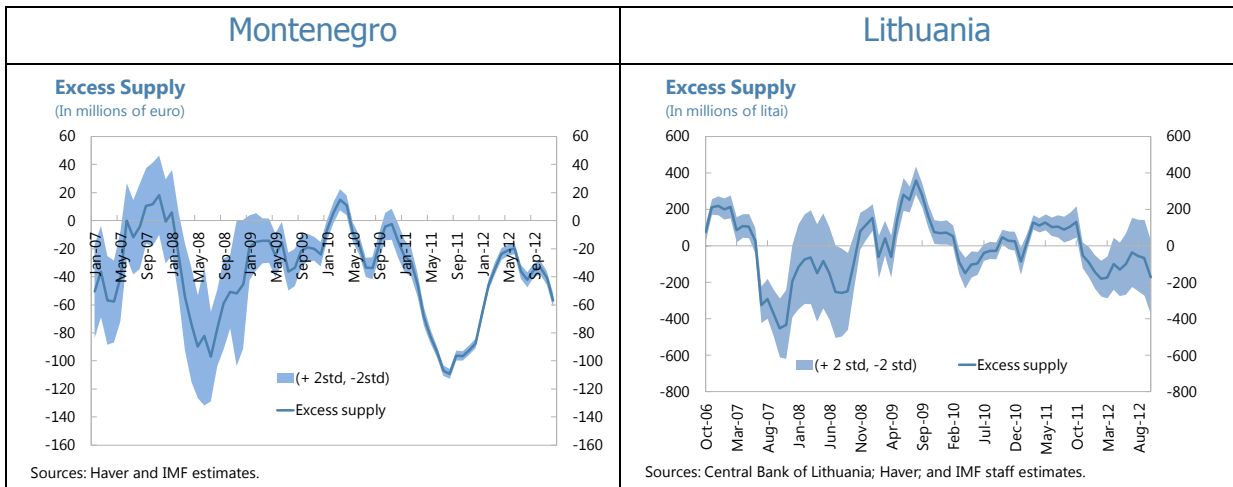
NFC: Actual and Predicted Credit
(In millions of RON)



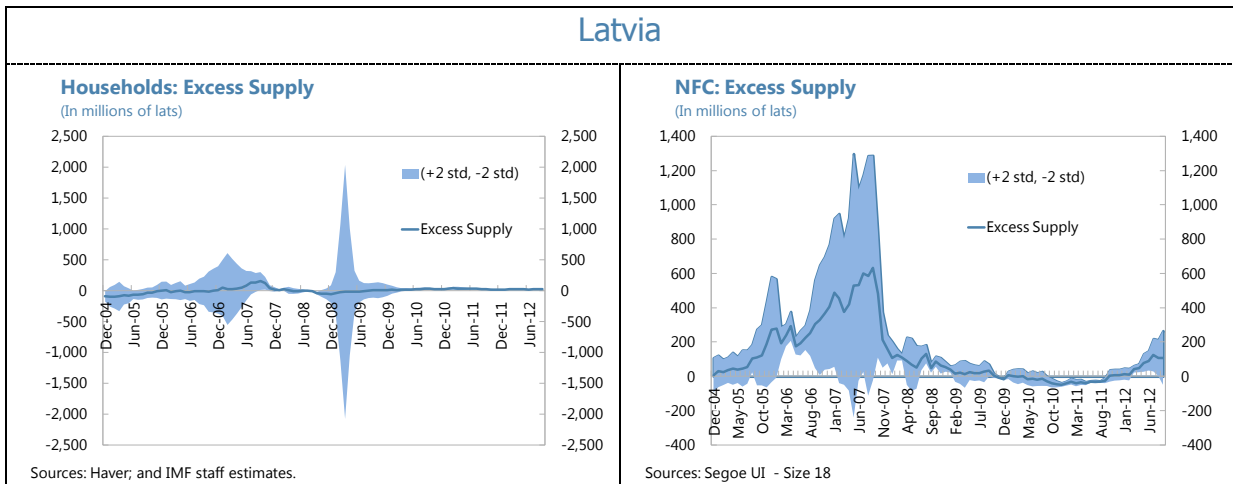
Sources: Haver, and IMF staff estimates.

Appendix V. Robustness Check on Significance of Excess Supply

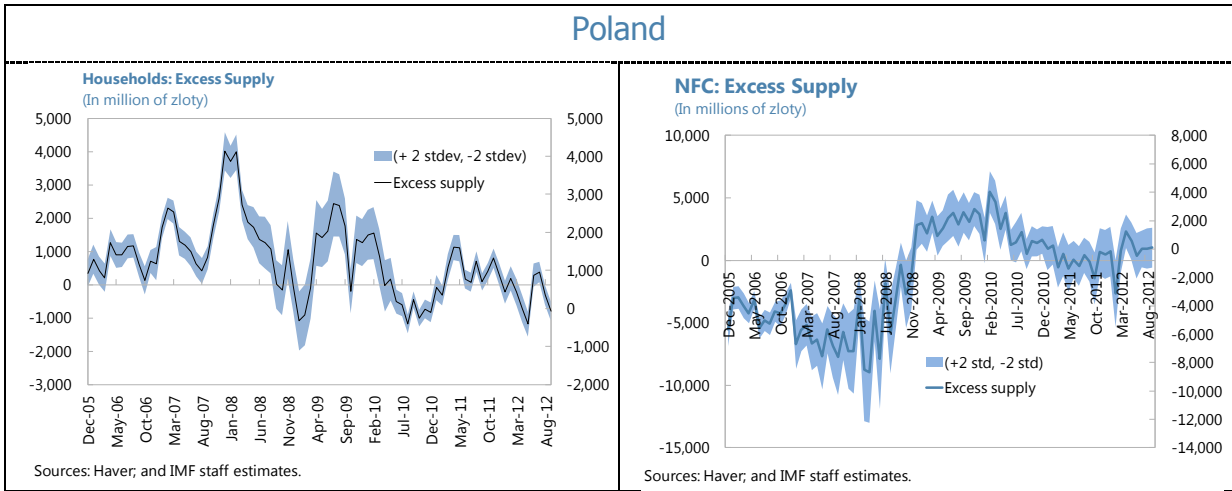
Montenegro & Lithuania



Latvia



Poland



Romania

